

**Space Weather Highlights**  
**30 March -05 April 1998**

Solar activity was low to moderate. Old Region 8179 (S22, L = 032, class/area Ekc/800 on 16 March) returned to the visible disk early on 04 April and was assigned SWO region number 8194. It produced a long-duration M1/SF flare at 05/1639UT as it crossed the east limb. Extremely intense coronal emissions were detected above the southeast limb prior to its arrival and signaled the continued potency of the region, which is situated within a band of historically active longitudes. There was also evidence the region produced coronal mass ejections while on the far side of the disk, another signal the region would be productive upon its return. Region 8195 (S26, L = 036, class/area Axx/030 on 05 April) rotated into view just to the southeast of 8194. Both regions shared a common inversion line and appeared to be part of an emerging region complex. Region 8190 (S20, L = 141, class/area Eai/230 on 01 April) was in a period of moderate growth during 31 March - 01 April and produced C-class subflares. A Type IV radio sweep occurred at 31/0252UT and a Type II radio sweep occurred at 31/0551UT; both were associated with flare activity in Region 8190. This region stabilized on 03 April, then gradually decayed.

Solar wind data were available from the ACE and WIND spacecraft during most of the period. Velocities ranged from 320 - 480 km/sec. Solar wind particle densities were in the 02 - 08 p/cc range. Bz was in the plus to minus 08 nT (GSM) range through 02 April. Solar sector orientation was mostly toward (phi angle near 315 degrees) through 02 April (interplanetary magnetic field data were sparse after 02 April).

There were no significant proton enhancements observed at geosynchronous altitude.

The greater than 2 MeV electron flux at geosynchronous altitude was at moderate to high levels through the first half of 03 April, then dropped to normal levels for the remainder of the period.

The geomagnetic field was quiet to unsettled. No significant disturbances were detected.

**Space Weather Forecast**  
**08 April 1998 - 04 May 1998**

Solar activity is expected to range from low to moderate. The 8194/8195 Region complex is expected to produce M-class flares until it crosses the west limb on 17 - 18 April. C-class flares will occur throughout the period.

No significant proton enhancements are expected at geosynchronous altitude.

The greater than 2 MeV electron flux at geosynchronous altitude is expected to be at normal to occasionally moderate levels.

The geomagnetic field is expected to be at quiet to unsettled levels during most of the period. No significant disturbances are expected.



### *Daily Solar Data*

Date	Radio Flux	Sun spot	Sunspot Area	X-ray Background	X-ray Flux			Flares				
	10.7 cm	No. (10 <sup>6</sup> hemi.)			C	M	X	S	1	2	3	4
30 March	108	66	510	B1.8	2	0	0	4	0	0	0	0
31 March	108	71	610	B4.6	5	0	0	11	0	0	0	0
01 April	106	90	720	B2.6	5	0	0	6	0	0	0	0
02 April	103	67	470	B4.3	7	0	0	8	0	0	0	0
03 April	104	74	410	B4.1	1	0	0	2	1	0	0	0
04 April	110	70	200	B5.2	4	0	0	15	0	0	0	0
05 April	126	82	500	B6.6	5	1	0	6	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
30 March	4.2E+5	1.8E+4	4.6E+3		8.3E+7	
31 March	1.6E+6	1.8E+4	4.9E+3		1.3E+8	
01 April	1.1E+6	1.9E+4	5.1E+3		1.7E+8	
02 April	9.8E+5	1.9E+4	5.2E+3		1.7E+8	
03 April	5.4E+5	2.1E+4	5.0E+3		6.2E+7	
04 April	3.0E+5	2.2E+4	5.2E+3		7.3E+6	
05 April	2.9E+5	2.9E+4	4.5E+3		3.0E+5	

### *Daily Geomagnetic Data*

Date	Middle Latitude		High Latitude		Estimated	
	Fredericksburg		College		Planetary	
	A	K-indices	A	K-indices	A	K-indices
30 March	6	0-1-3-2-2-2-1-2	19	1-2-5-4-4-4-1-1	10	1-1-4-3-3-3-2-2
31 March	7	2-3-3-1-2-0-2-1	11	2-4-5-1-0-0-0-0	10	3-4-4-1-2-2-2-1
01 April	2	1-2-1-0-0-0-1-1	4	1-1-3-2-0-0-0-0	5	1-2-2-1-1-2-2-1
02 April	1	0-0-0-0-0-0-1-2	*	0-0-0-*-0-0-1-2	4	0-0-0-1-2-2-2-3
03 April	5	2-1-2-0-3-2-1-0	*	1-0-1-*-1-2-2-1	6	2-1-2-1-2-3-2-1
04 April	8	2-3-3-0-2-1-1-3	*	*-*-*-*-**-*	10	2-3-3-2-3-3-1-2
05 April	3	1-1-1-1-1-1-1-0	4	1-1-2-2-2-1-0-0	4	1-0-1-1-1-2-2-0



*Alerts and Warnings Issued*

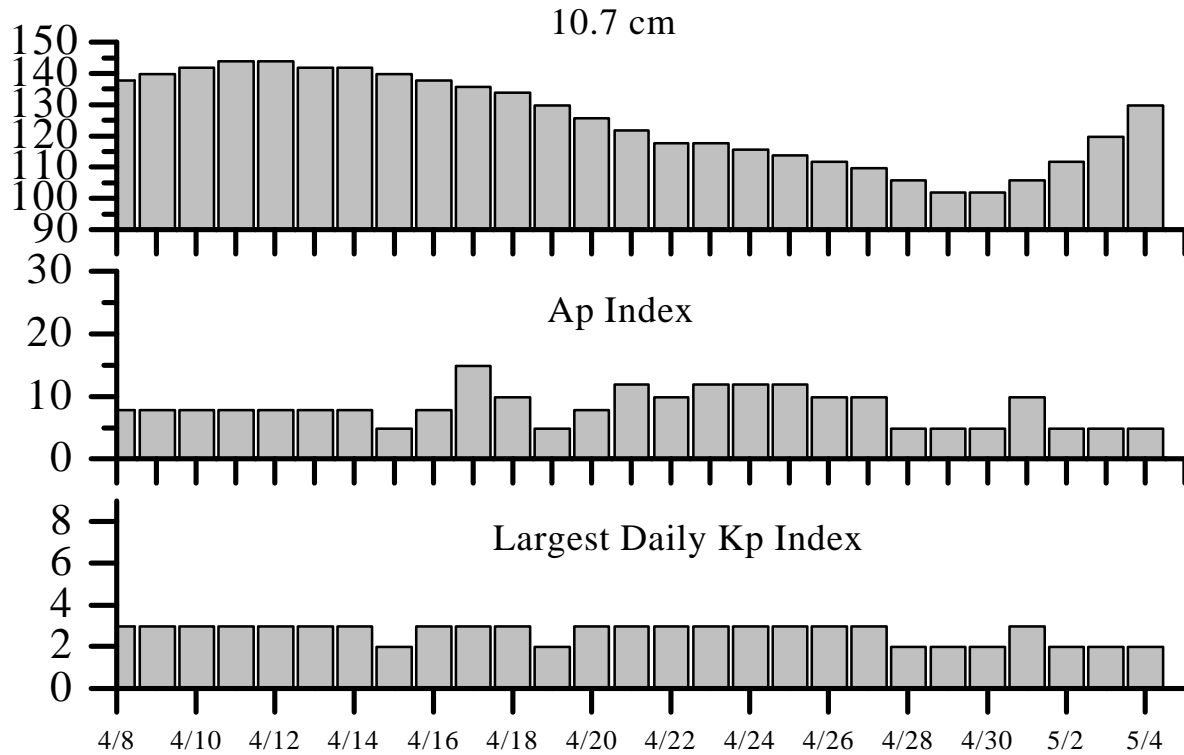
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Date and Time of Issue (UT)	Type of Alert or Warning	Date and Time of Event (UT)
31 Mar 0000	>2 MeV Electron Event in Progress $\geq 1000$ pfu	30 Mar
31 Mar 0540	Type IV Radio Emission	31 Mar 0252
31 Mar 2033	A $\geq 20$ Watch	01 Apr
31 Mar 2359	>2 MeV Electron Event in Progress $\geq 1000$ pfu	31 Mar
01 Apr 0038	Type II Radio Emission	31 Mar 0551
02 Apr 0000	>2 MeV Electron Event in Progress $\geq 1000$ pfu	01 Apr
02 Apr 0040	2-245 MHz Radio Bursts	01 Apr
02 Apr 0040	245 MHz Radio Noise Storm	01 Apr
03 Apr 0000	>2 MeV Electron Event in Progress $\geq 1000$ pfu	02 Apr
04 Apr 0000	>2 MeV Electron Event in Progress $\geq 1000$ pfu	03 Apr
05 Apr 0000	>2 MeV Electron Event in Progress $\geq 1000$ pfu	04 Apr

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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
08 Apr	138	8	3	22	118	10	3
09	140	8	3	23	118	12	3
10	142	8	3	24	116	12	3
11	144	8	3	25	114	12	3
12	144	8	3	26	112	10	3
13	142	8	3	27	110	10	3
14	142	8	3	28	106	5	2
15	140	5	2	29	102	5	2
16	138	8	3	30	102	5	2
17	136	15	3	01 May	106	10	3
18	134	10	3	02	112	5	2
19	130	5	2	03	120	5	2
20	126	8	3	04	130	5	2
21	122	12	3				



***Energetic Events***

Date	Time (UT)		X-ray		Optical Information			Peak		Sweep Freq		
	Begin	Max	½	Integ	Imp	Location		Rgn	Radio Flux		Intensity	
			Max			Class	Flux		Brtns	Lat	CMD	#
05 Apr	1622	1639	1710	M1.0	.021	SF	S20E84	8194	66			

***Flare List***

Date	Time			X-ray	Imp /	Optical		Rgn
	Begin	Max	End			Class.	Brtns	
30 March	1324	1327	1330	B4.0				
	1405	1409	1420	B4.9				
	1534	1544	1548		SF	S24W40	8185	
	1557	1558	1602		SF	S24W40	8185	
	1947	1952	1955	C1.4				
	2013	2014	2016		SF	S25E51	8190	
	2013	2014	2017		SF	S25W46	8189	
	2345	2351	2355	C3.5				
31 March	0258	0300	0315	C2.0	SF	S23E34	8190	
	0358	0401	0404	C1.1				
	0501	0507	0511	B8.9				
	0545	0548	0552	C1.4	SF	S21E50	8190	
	0730	0734	0748		SF	S26W63	8189	
	0751	0753	0805		SF	S25E42	8190	
	0855	0907	0916	C1.1				
	0934	0935	0938		SF	S29W67	8189	
	1332	1334	1339	C1.0	SF	S21E44	8190	
	1414	1414	1418		SF	S24E42	8190	
	1434	1436	1442		SF	S24E42	8190	
1451	1454	1500		SF	S24E41	8190		
1713	1714	1717		SF	S25E38	8190		
1742	1743	1747		SF	S25E38	8190		
01 April	0621	0625	0628	B5.9				
	0921	0923	0931	C2.7	SF	S23E17	8190	
	1356	1358	1400	C1.4	SF	S20W69	8185	
	1522	1538	1632	C2.1	SF	S23E25	8190	
	1956	2004	2015	C1.0	SF	S23E25	8190	
	2202	2210	2228	C1.2	SF	S23E22	8190	
	2329	2329	2334		SF	S23E23	8190	
02 April	0138	0140	0143		SF	S23E08	8190	
	0259	0302	0304	B5.1				
	0431	0433	0443	B7.9	SF	S23E07	8190	
	0519	0530	0539	C1.0				
	0735	0737	0744		SF	S23E05	8190	
	0754	0755	0814	C1.4	SF	S23E05	8190	



*Flare List – continued.*

Date	Time			X-ray Class.	Optical		Rgn #
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
02 April	0917	0919	0930		SF	S23E30	8191
	0959	1004	1013	B9.0			
	1104	U1106	A1151	C1.0	SF	S24E31	8191
	1152	1247	1328	C1.1			
	1427	1428	1447	C2.3	SF	S22E24	8190
	1643	1647	1712	C1.8	SF	S23E23	8190
	2152	2216	2311	C1.2			
03 April	1024	1054	1249	B9.2			
	1857	1901	1904		SF	S20E06	8190
	1912	1916	1929		SF	S20E07	8190
	2337	2349	0021	C6.7	1N	S22E07	8190
04 April	0739	0757	0834	C6.2			
	1102	1105	1110		SF	S22W13	8190
	1148	1150	1156		SF	S23E02	8191
	1344	1346	1356		SF	S24E46	8193
	1405	1406	1408		SF	S24E42	8193
	1439	1443	1447	C1.2			
	1806	1807	1816		SF	S23W01	8190
	1819	1825	1833	C2.2			
	1840	1847	1851		SF	S23E44	8193
	1848	1849	1854		SF	S23W02	8190
	1852	1911	1917		SF	S23E43	8193
	1857	1859	1910		SF	S19W12	8190
	1923	1928	1942		SF	S23E43	8193
	2021	2022	2025		SF	S23E43	8193
	2034	2037	2045		SF	S22W02	8190
	2046	2053	2059	C2.6			
	2138	2139	2148		SF	S22W03	8190
	2259	2307	2320		SF	S23E42	8193
	2332	2336	2339		SF	S23E41	8193
	05 April	0355	0402	0412	C2.1		
0808		0820	0842	C3.3			
1150		1151	1157	C1.1	SF	S20E35	8193
1303		1315	1324	C4.9			
1339		1339	1351		SF	S22E33	8193
1632		1634	1644	M1.0	SF	S20E84	8194
1742		1742	1753		SF	S20E83	8194
1759		1801	1803		SF	S19E86	8194
1950		1951	1956		SF	S20E68	8194
2155		2200	2205	C3.6			



## 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 8184</i>																					
20 Mar	S18E46	276	0050	04	CSO	003	B														
21 Mar	S19E33	276	0040	06	DSO	003	B														
22 Mar	S20E20	276	0040	07	DSO	004	B														
23 Mar	S20E06	277	0040	08	DSO	004	B														
24 Mar	S20W06	275	0020	08	BXO	005	B														
25 Mar	S21W17	273	0000	00	AXX	001	A														
26 Mar	S21W30	273																			
27 Mar	S21W43	273																			
28 Mar	S21W56	273																			
29 Mar	S21W69	273																			
30 Mar	S21W82	273																			
31 Mar	S21W95	273																			
													0	0	0	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude: 277

<i>Region 8185</i>																				
20 Mar	S24E64	258	0000	00	AXX	001	A													
21 Mar	S24E71	238	0080	12	CSO	006	B					1								
22 Mar	S24E63	233	0350	16	FKI	015	B	1	1			5	1							
23 Mar	S25E50	233	0510	18	FKC	018	BG													
24 Mar	S24E37	232	0650	19	FKC	021	BG					4								
25 Mar	S25E24	232	0580	20	FKC	027	BG	1				4								
26 Mar	S25E12	231	0530	22	FHC	037	BG		1			1		1						
27 Mar	S24W03	233	0480	25	FKC	031	BG	1	1			2				1				
28 Mar	S26W15	232	0430	20	FKI	024	BG													
29 Mar	S25W27	230	0450	20	FKO	018	BG													
30 Mar	S25W39	229	0390	19	FKI	016	BG					2								
31 Mar	S25W51	228	0480	20	FHI	016	BG													
01 Apr	S25W64	228	0440	20	FHO	012	BG	1				1								
02 Apr	S24W75	226	0290	16	FAO	003	B													
03 Apr	S25W85	223	0210	13	CAO	005	B													
04 Apr	S22W95	219	0070	01	AXX	001	A													
													4	3	0	20	1	1	1	0

Crossed West Limb.

Absolute heliographic longitude: 233









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

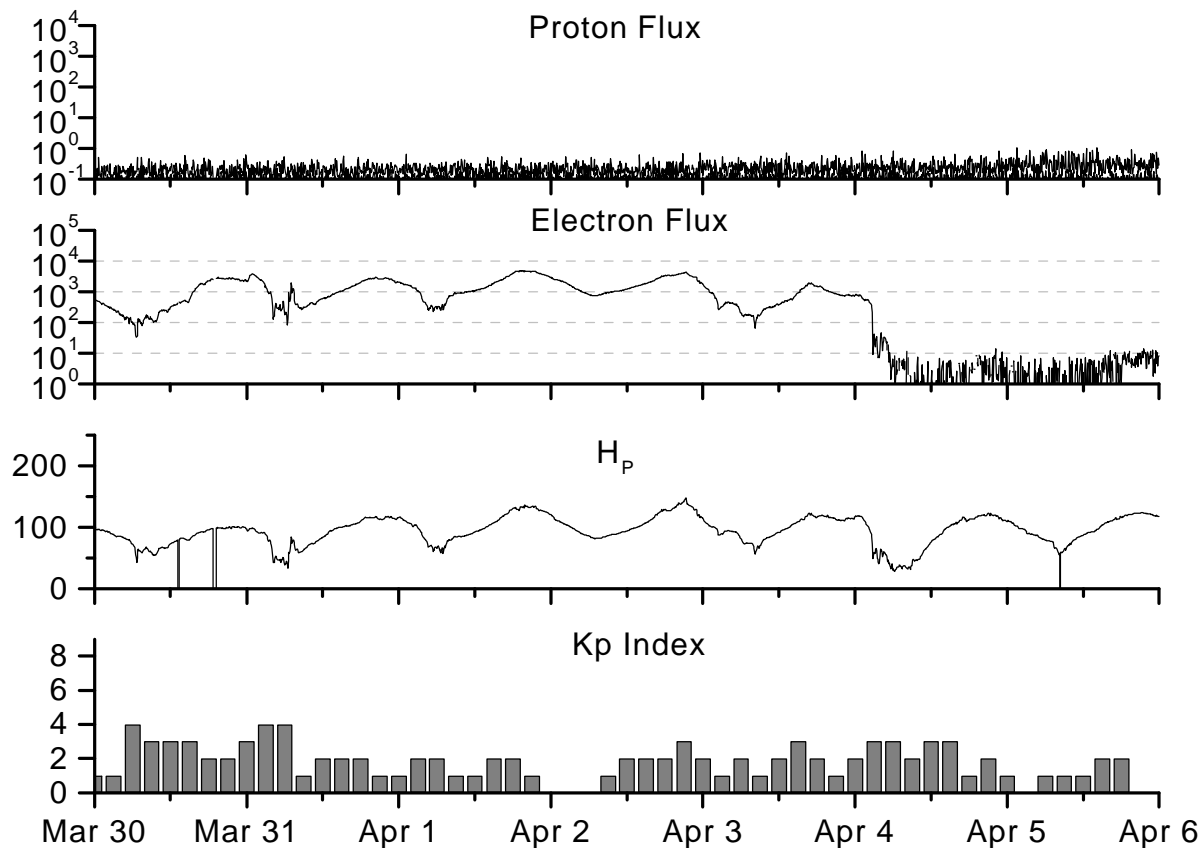
Month	Sunspot Numbers				Radio Flux		Geomagnetic		
	Observed SWO	values RI	Ratio RI/SWO	Smooth SWO	values RI	**Penticton 10.7 cm	Smooth Value	Planetary Ap	Smooth Value
<b>1996</b>									
April	08.5	04.8	0.56	13.6	08.5	69.3	71.6	11	09.7
May	11.8	05.5	0.47	12.9	08.0	72.1	71.4	07	09.5
June	18.8	11.8	0.63	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
<b>1997</b>									
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*	
<b>1998</b>									
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 30 March 1998*

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

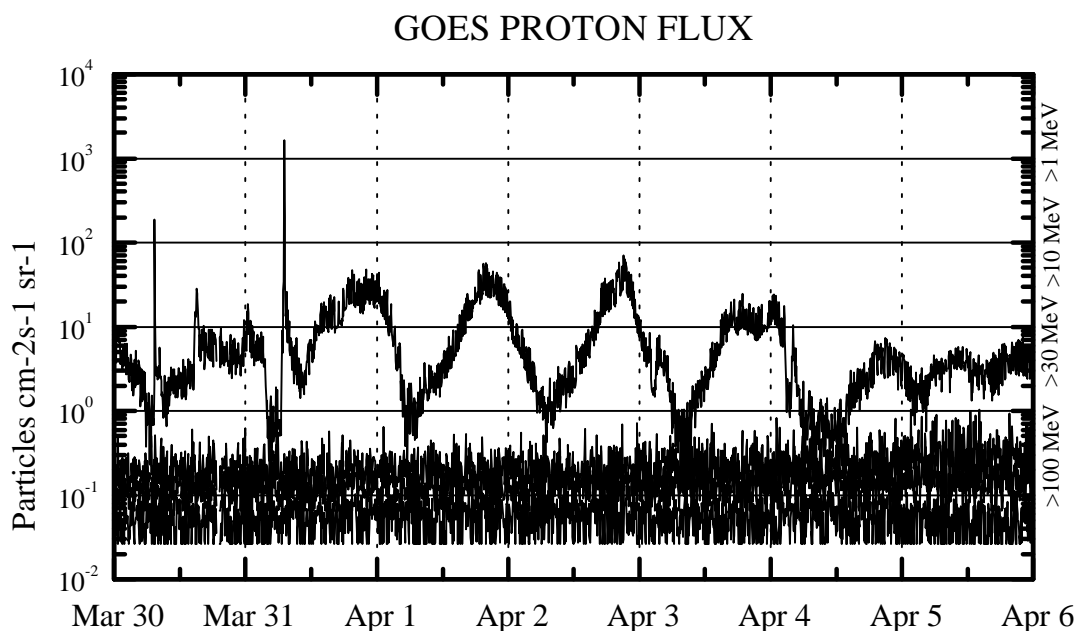
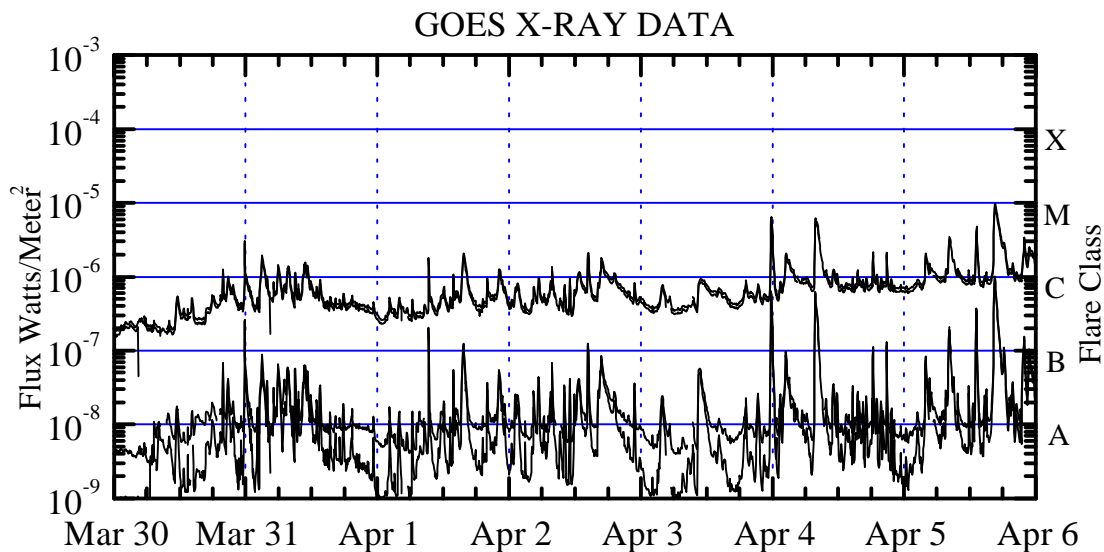
*Electrons* plot contains the five-minute averaged integral electron flux (electrons/ cm<sup>2</sup> -sec-sr) with energies greater than 2 MeV at GOES-9.

*H<sub>p</sub>* 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<sub>p</sub>* plot contains the estimated planetary 3-hour K-index (derived by the USAF 55<sup>th</sup> 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<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>parallel</sub> 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/cm<sup>2</sup>-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/cm<sup>2</sup>-sec-sr) at greater than 10 MeV.

X-ray plot contains five minute averaged x-ray flux (watts/m<sup>2</sup>) 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.

