

**Space Weather Highlights
12-18 April 1999**

Solar activity ranged from very low to low levels. The disk was populated by small, simple sunspot groups, a few of which produced isolated B- and C-class subflares. SOHO/LASCO images showed two partial-halo CME events during the period. The first occurred around 13/0330UT, the second around 17/0600UT.

Real-time solar wind data were available from the Advanced Composition Explorer (ACE) spacecraft for most of the period. The 13/0330UT CME mentioned above reached the Earth near midday on 16 April accompanied by a velocity increase from 380 - 470 km/sec, southward IMF Bz deflections to minus 13 nT (GSM), and a brief particle density increase to 68 p/cc. Earth was within an away solar sector (positive polarity) during the period.

There were no significant proton enhancements detected at geo-synchronous altitude.

The greater than 2 MeV electron flux at geo-synchronous altitude reached high levels during 12 - 13 April, then declined to normal to moderate levels for the rest of the period.

The geomagnetic field was at quiet to unsettled levels during 12 - 15 April. A geomagnetic disturbance occurred during 16 - 17 April following a 12 nT sudden impulse at 16/1126UT (as measured by the Boulder USGS magnetometer). Active to major storm levels occurred at all latitudes during the disturbance. The disturbance was likely due to the CME observed at 13/0330UT. Field activity declined to quiet to unsettled levels after 17/1200UT.

**Space Weather Outlook
21 April - 17 May 1999**

Solar activity is expected to be at low to moderate levels. Mostly low activity is expected through 29 April. An increasing trend is expected to begin around 30 April with the return of historically active longitudes.

No significant proton enhancements are expected at geo-synchronous altitude.

The greater than 2 MeV electron flux at geo-synchronous altitude may reach high levels around 27 - 30 May. Otherwise, normal to moderate levels are expected.

Geomagnetic field activity may increase to active to minor storm levels during 21 April in response to the partial-halo CME observed on 17 April. Active to minor storm levels are also possible during 25 - 28 April due to a recurrent coronal hole high-speed wind stream. Quiet to unsettled levels are expected during the rest of the period (barring any Earth-directed coronal mass ejections).



Daily Solar Data

Date	Radio Flux 10.7 cm	Sun spot No. (10 ⁶ hemi.)	Sunspot Area	X-ray Background	Flares							
					X-ray Flux			Optical				
					C	M	X	S	1	2	3	4
12 April	130	113	270	B2.3	1	0	0	6	0	0	0	0
13 April	130	122	210	B2.4	1	0	0	3	1	0	0	0
14 April	120	107	200	B2.1	0	0	0	2	0	0	0	0
15 April	122	95	120	B2.0	1	0	0	0	0	0	0	0
16 April	123	87	200	B2.8	0	0	0	0	0	0	0	0
17 April	116	99	300	B2.6	0	0	0	5	0	0	0	0
18 April	113	98	220	B1.8	0	0	0	2	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
12 April	2.1E+5	1.5E+4	3.3E+3		4.8E+7	
13 April	2.2E+5	1.5E+4	3.3E+3		6.3E+7	
14 April	1.1E+5	1.4E+4	3.3E+3		1.9E+7	
15 April	5.1E+4	1.5E+4	3.2E+3		9.8E+6	
16 April	3.0E+5	1.4E+4	3.1E+3		1.0E+7	
17 April	1.5E+5	1.4E+4	2.9E+3		3.8E+5	
18 April	5.5E+4	1.5E+4	3.2E+3		4.8E+5	

Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
12 April	6	3-1-1-3-1-1-1-1	*	2-1-0-*-3-1-1-2	7	3-1-2-3-3-3-1-1
13 April	2	0-0-1-1-1-1-1-1	4	0-0-0-3-1-2-1-1	5	1-0-1-1-2-1-1-1
14 April	6	1-1-3-2-1-1-2-2	6	1-1-3-3-1-2-1-0	7	2-0-3-3-1-2-2-2
15 April	2	1-0-1-1-0-1-1-1	3	1-0-0-1-0-1-1-3	4	1-0-1-1-1-2-1-2
16 April	13	1-2-0-2-3-2-3-5	8	1-1-0-1-3-3-2-3	14	1-1-0-2-3-4-3-5
17 April	30	6-6-4-4-2-1-2-2	38	5-6-5-6-3-2-3-2	47	6-7-6-5-3-3-3-3
18 April	5	2-2-0-2-2-1-2-1	8	2-2-0-1-4-2-2-1	6	2-2-1-2-3-2-2-1

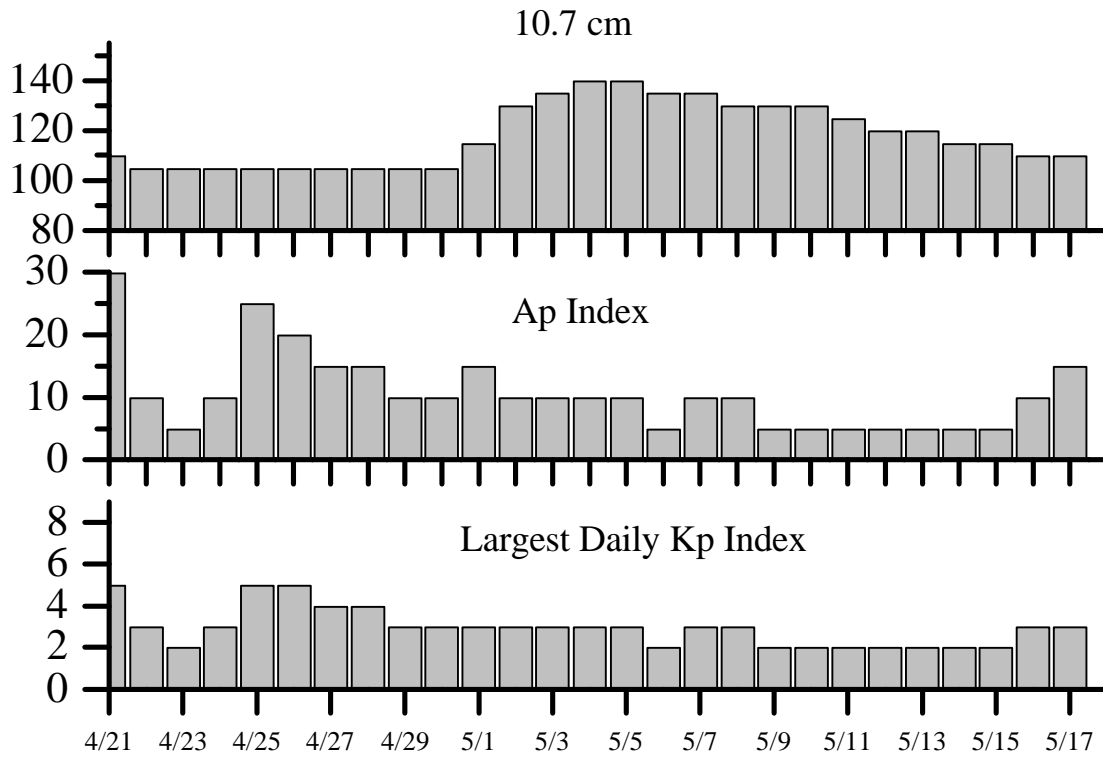


Alerts and Warnings Issued

Date and Time of Issue (UT)	Type of Alert or Warning	Date and Time of Event (UT)
12 Apr 1730	>2MeV Electron Event ≥ 1000 pfu	12 Apr 1715
13 Apr 1318	>2MeV Electron Event ≥ 1000 pfu CONTINUED	13 Apr 1300
14 Apr 1743	A-Index ≥ 20 Watch for	16 Apr
14 Apr 1744	A-Index ≥ 20 Watch for	17 Apr
16 Apr 1144	Sudden Impulse of 12 nT at Boulder	16 Apr 1126
16 Apr 1800	K-Index of 4	16 Apr 15- 18
16 Apr 1902	K= 4 Warning valid	16 Apr 1900-17 Apr 15:00
17 Apr 148	K= 6 Warning valid from	17 Apr 01:40 to 15:00
17 Apr 303	A ≥ 20 Observed	17 Apr 03:00
17 Apr 303	K= 6 Observed	17 Apr 00:00 to 03:00
17 Apr 421	A ≥ 30 Warning valid	17 Apr 0414 - 23:59
17 Apr 558	A ≥ 30 Observed	17 Apr 0600
18 Apr 556	A ≥ 30 ENDED	17 Apr 0600
18 Apr 2003	A ≥ 20 Watch	21 Apr



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	110	30	5	05 May	140	10	3
22	105	10	3	06	135	5	2
23	105	5	2	07	135	10	3
24	105	10	3	08	130	10	3
25	105	25	5	09	130	5	2
26	105	20	5	10	130	5	2
27	105	15	4	11	125	5	2
28 Apr	105	15	4	12	120	5	2
29	105	10	3	13	120	5	2
30	105	10	3	14	115	5	2
01 May	115	15	3	15	115	5	2
02	130	10	3	16	110	10	3
03	135	10	3	17	110	15	3
04	140	10	3				



Energetic Events

Date	Time (UT)		X-ray	Optical Information			Peak		Sweep Freq	
	Begin	Max		Class	Imp Brtns	Location Lat CMD	Rgn #	Radio Flux		Intensity
			1/2					Max	Flux	245

No Events Observed

Flare List

Date	Time			X-ray Class.	Imp / Brtns	Optical Location Lat CMD	Rgn #
	Begin	Max	End				
12 April	0551	0557	0603	B4.0	SF	N24W39	8508
	B1130	U1131	A1145		SF	S33E16	
	1726	1738	1752	C1.2	SF	S35E13	
	1946	1947	1957		SF	S33E08	
	2003	2009	2018		SF	S33E11	
	2033	2037	A2037		SF	S33E10	
13 April	0508	0644	0813	B4.0			
	0855	0900	0906	B7.7			
	0918	0921	0923	B6.2			
	B1135	U1136	A1150		SF	N23W46	8508
	1257	1300	1310		SF	N23W46	8508
	1747	1751	1817	C1.9	1F	S19E10	8515
	1836	1838	1841		SF	S19E11	8515
14 April	2212	2216	2219	B4.5			
	0806	0808	0812		SF	S28W25	8512
	B1827	U1827	1926		SF	S19W04	8515
15 April	0217	0239	0333	C1.1			
	1547	1608	1642	B8.5			
	1943	1946	1959	B4.9			
16 April	0708	0712	0716	B4.9			
	0959	1002	1004	B4.5			
	1048	1052	1056	B5.4			
	1937	1941	1947	B3.8			
17 April	0653	0654	0704		SF	S28W56	8512
	0654	0655	0706		SF	S29W50	8514
	1821	1822	1831		SF	N17W28	8519
	2033	2034	2042	B4.6	SF	S31W55	8514
	2112	2119	2125	B3.4			
	2217	2223	2232	B3.5			
18 April	2338	2342	2347	B6.0	SF	S33W55	8514
	0840	0844	0849	B3.8			
	1133	1142	1147	B3.7			
	1437	1441	1444		SF	N17W79	
	2041	2044	2047	B3.7			
	2115	2116	2121	B7.6	SF	N21W52	8517
	2251	2255	2308	B3.1			



Region Summary

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

Region 8507

03 Apr	N12E58	302	0010	05	BXO	005	B	1				4						
04 Apr	N11E45	302	0010	07	BXO	006	B					1						
05 Apr	N12E32	302	0050	08	CSO	011	B											
06 Apr	N12E18	303	0030	07	CSO	011	B	1				5						
07 Apr	N11E05	303	0080	08	DAO	014	B					3						
08 Apr	N12W10	304	0070	07	DSO	011	B											
09 Apr	N11W23	304	0050	07	DSO	005	B											
10 Apr	N11W37	305	0020	07	DRO	006	B											
11 Apr	N11W49	304	0010	05	BXO	004	B											
12 Apr	N11W62	304																
13 Apr	N11W75	304																
14 Apr	N11W88	304																
								2	0	0	13	0	0	0	0	0		

Crossed West Limb.

Absolute heliographic longitude: 303

Region 8508

03 Apr	N19E77	283	0050	02	HSX	003	A		1			1	1					
04 Apr	N20E63	284	0090	08	CAO	006	B		1				2					
05 Apr	N21E49	285	0160	10	DAO	015	BG	2				4						
06 Apr	N21E36	285	0110	11	EAO	014	BG	1				1						
07 Apr	N22E24	284	0120	09	DAI	021	BG	1				4						
08 Apr	N22E12	282	0190	09	DAI	039	BG	6	1			8						
09 Apr	N23W02	283	0150	10	DAI	033	BG	2				6						
10 Apr	N22W16	284	0190	10	DAI	036	BG	1				3						
11 Apr	N21W28	283	0120	11	EAI	025	B	1				3						
12 Apr	N22W42	284	0060	10	DSO	013	B					1						
13 Apr	N21W55	283	0030	07	BXO	006	B					2						
14 Apr	N23W66	281	0010	08	BXO	003	B					1						
15 Apr	N23W79	281																
								14	3	0	34	3	0	0	0	0		

Crossed West Limb.

Absolute heliographic longitude: 283



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 8509</i>																	
05 Apr	N11E51	283	0010	00	BXO	001	B											
06 Apr	N11E38	283																
07 Apr	N11E25	283										1						
08 Apr	N11E12	283																
09 Apr	N14E03	278	0010	03	BXO	003	B											
10 Apr	N15W07	275																
11 Apr	N15W20	275																
12 Apr	N14W31	273	0010	03	BXO	002	B											
13 Apr	N13W44	272	0010	04	BXO	004	B											
14 Apr	N13W57	272																
15 Apr	N13W70	272																
												0	0	0	1	0	0	0

Died on Disk.

Absolute heliographic longitude: 278

Region 8510

06 Apr	S34E53	268	0020	01	HSX	001	A											
07 Apr	S34E39	269	0010	08	BXO	003	B											
08 Apr	S35E24	270	0000	01	AXX	001	A											
09 Apr	S35E11	270	0010	03	BXO	002	B											
10 Apr	S35W02	270																
11 Apr	S35W15	270																
12 Apr	S35W28	270																
13 Apr	S35W41	270																
14 Apr	S35W54	270																
15 Apr	S35W67	270																
												0	0	0	0	0	0	0

Died on Disk.

Absolute heliographic longitude: 270



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 8511</i>																		
06 Apr	S17E59	262	0100	06	DAO	006	B											
07 Apr	S17E46	262	0130	07	DAO	005	B											1
08 Apr	S17E33	261	0110	07	DAO	005	B											
09 Apr	S17E21	260	0100	07	DSO	004	B											
10 Apr	S16E07	261	0110	08	DAO	006	B											
11 Apr	S17W05	260	0120	08	DAO	004	B											
12 Apr	S16W19	261	0080	08	DSO	005	B											
13 Apr	S16W33	261	0020	08	CSO	003	B											
14 Apr	S20W49	264	0020	02	HSX	002	A											
15 Apr	S17W61	263	0000	00	AXX	001	A											
16 Apr	S15W74	263																
17 Apr	S15W87	263																
																		0 0 0 1 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 260

Region 8512

08 Apr	S27E52	242	0010	05	BXO	004	B											
09 Apr	S28E38	243	0060	04	CSO	006	B											
10 Apr	S27E25	243	0060	06	DAO	007	B											
11 Apr	S27E12	243	0050	06	DAO	006	B											
12 Apr	S28W02	244	0030	06	CSO	005	B											
13 Apr	S27W17	245	0030	04	CSO	006	B											
14 Apr	S27W31	246	0030	02	CAO	003	B											1
15 Apr	S27W44	246	0000	00	AXX	001	A											
16 Apr	S27W55	244	0000	00	AXX	001	A											
17 Apr	S24W69	245	0010	01	HSX	001	A											1
18 Apr	S27W82	244	0010	00	AXX	001	A											
																		0 0 0 2 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 244



Region Summary-continued

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

Region 8513

09 Apr	S18E49	232	0020	09	BXO	003	B										
10 Apr	S18E35	233	0090	07	DAO	012	B										
11 Apr	S18E21	234	0070	07	DSO	014	B										
12 Apr	S18E09	233	0060	08	DAO	018	B										
13 Apr	S18W05	233	0060	07	DAO	013	B										
14 Apr	S15W20	235	0040	07	CAO	008	B										
15 Apr	S17W34	236	0010	02	BXO	004	B										
16 Apr	S18W44	233	0010	01	AXX	002	A										
17 Apr	S18W57	233															
18 Apr	S18W70	233															
													0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 233

Region 8514

12 Apr	S33E08	234	0030	06	BXO	010	B										
13 Apr	S33W06	234	0040	06	CAO	011	B										
14 Apr	S34W24	239	0030	08	CAO	008	B										
15 Apr	S33W33	235	0020	06	BXO	007	B										
16 Apr	S32W47	236	0030	03	CSO	003	B										
17 Apr	S30W58	234	0080	11	EAO	009	B										3
18 Apr	S33W69	231	0030	11	BXO	006	B										
														0	0	0	3
														0	0	0	0

Still on Disk.

Absolute heliographic longitude: 234

Region 8515

13 Apr	S20E06	222	0020	04	BXO	009	B	1									1
14 Apr	S11W10	225	0010	05	BXO	008	B										1
15 Apr	S18W20	222	0040	05	CAO	014	B										
16 Apr	S16W31	220	0070	06	DAO	009	B										
17 Apr	S16W44	220	0030	08	DAO	008	B										
18 Apr	S18W56	218	0010	07	BXO	005	B										
														1	0	0	1
														1	1	0	0

Still on Disk.

Absolute heliographic longitude: 222



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 8516</i>																
14 Apr	S21E68	147	0060	09	CAO	005	B									
15 Apr	S19E55	147	0050	09	CAO	008	B									
16 Apr	S20E44	145	0070	08	CAO	008	B									
17 Apr	S20E30	146	0080	09	CAO	005	B									
18 Apr	S18E16	146	0060	06	CSO	005	B									
								0	0	0	0	0	0	0	0	0
Still on Disk.																
Absolute heliographic longitude: 146																
<i>Region 8517</i>																
16 Apr	N20W21	210	0020	03	BXO	004	B									
17 Apr	N22W36	212	0030	07	CSO	003	B									
18 Apr	N22W51	213	0030	07	CRO	006	B					1				
								0	0	0	1	0	0	0	0	0
Still on Disk.																
Absolute heliographic longitude: 210																
<i>Region 8518</i>																
17 Apr	S16E66	110	0060	02	HAX	002	A									
18 Apr	S14E53	109	0080	02	HAX	004	A									
								0	0	0	0	0	0	0	0	0
Still on Disk.																
Absolute heliographic longitude: 109																
<i>Region 8519</i>																
17 Apr	N17W33	209	0010	01	HRX	001	A					1				
18 Apr	N18W47	209	0000	00	AXX	001	A									
								0	0	0	1	0	0	0	0	0
Still on Disk.																
Absolute heliographic longitude: 209																



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

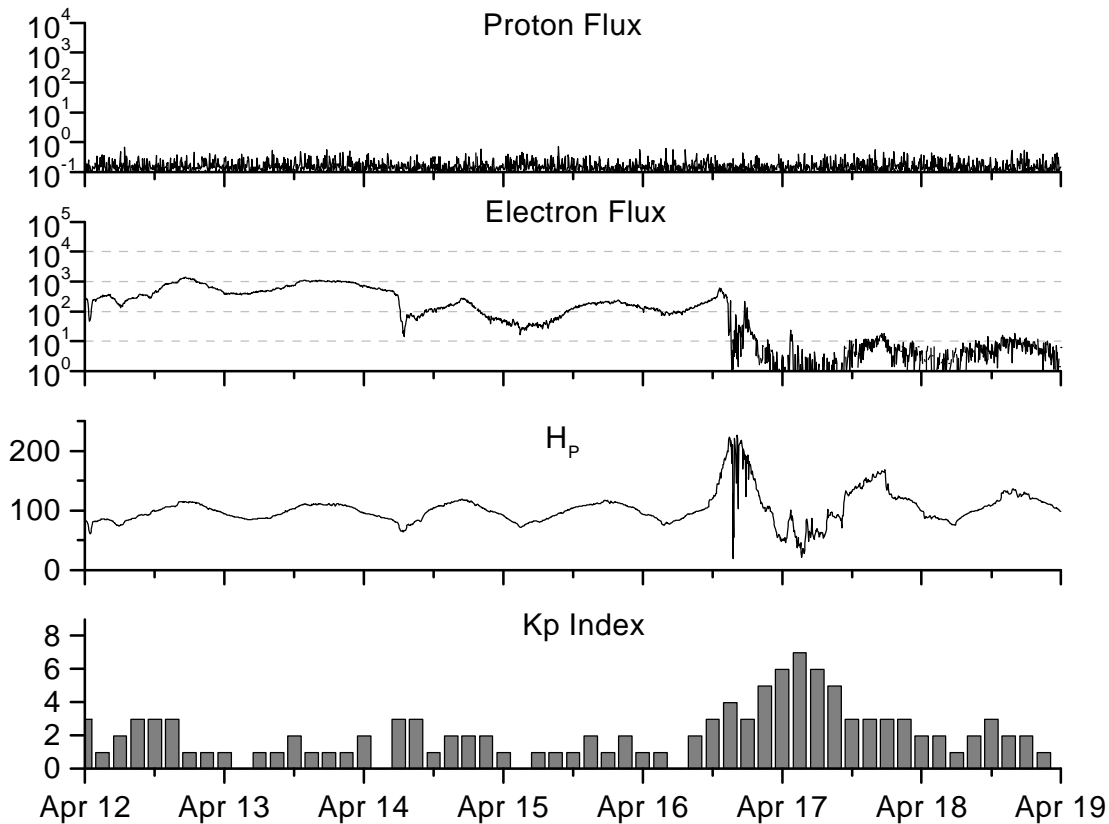
Month	Sunspot Numbers			Radio Flux		Geomagnetic			
	Observed values SWO	Ratio RI	Ratio RI/SWO	Smooth values SWO	Smooth values RI	**Penticton 10.7 cm	Smooth Value	Planetary Ap	Smooth Value
1997									
April	24.5	15.5	0.63	24.0	16.5	74.5	76.8	10	08.6
May	28.6	18.5	0.65	26.4	18.3	74.6	78.4	08	08.6
June	22.1	12.7	0.57	29.0	20.3	71.7	80.1	07	08.6
July	17.0	10.4	0.61	32.4	22.6	71.1	81.8	06	08.5
August	36.7	24.4	0.66	35.9	25.0	79.0	83.4	07	08.3
September	52.8	51.3	0.88	40.5	28.3	96.2	85.7	10	08.4
October	33.6	22.8	0.68	45.4	31.8	84.9	88.6	11	08.6
November	53.5	39.0	0.73	49.3	35.0	99.5	91.3	11	09.0
December	57.9	41.2	0.71	54.2	39.0	98.8	94.2	05	09.5
1998									
January	51.8	31.9	0.62	60.6	43.7	93.4	97.5	08	09.9
February	54.4	40.3	0.74	67.4	48.8	93.4	101.7	08	10.5
March	81.8	54.8	0.67	73.3	53.4	109.1	105.8	13	11.1
April	73.6	53.4	0.73	77.7	56.5	108.3	109.1	10	11.3
May	74.3	56.3	0.76	81.4	59.3	106.7	112.4	18	11.6
June	93.6	70.7	0.76	85.9	62.4	108.4	116.2	10	11.9
July	98.3	66.2	0.67	90.3	65.4	114.0	120.3	11	12.2
August	118.6	91.7	0.77			136.0		18	12.4
September	119.0	92.9	0.78			138.4		14	12.5
October	77.0	55.6	0.72			121.9		13	
November	99.5	73.6	0.74			140.2		16	
December	120.8	81.6	0.68			150.1		08	
1999									
January	94.3	62.4	0.66			142.6		10	
February	93.4	66.1	0.70			142.0		11	
March	100.5	69.1	0.70			126.3		13	

NOTE: All smoothed values after January 1998 and monthly values after September 1998 are 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.

* 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 1999*

Protons plot contains the five-minute averaged integral proton flux (protons/ cm²-sec-sr) as measured by GOES-8 (W75) for each of three energy thresholds: greater than 10, 50, and 100 MeV.

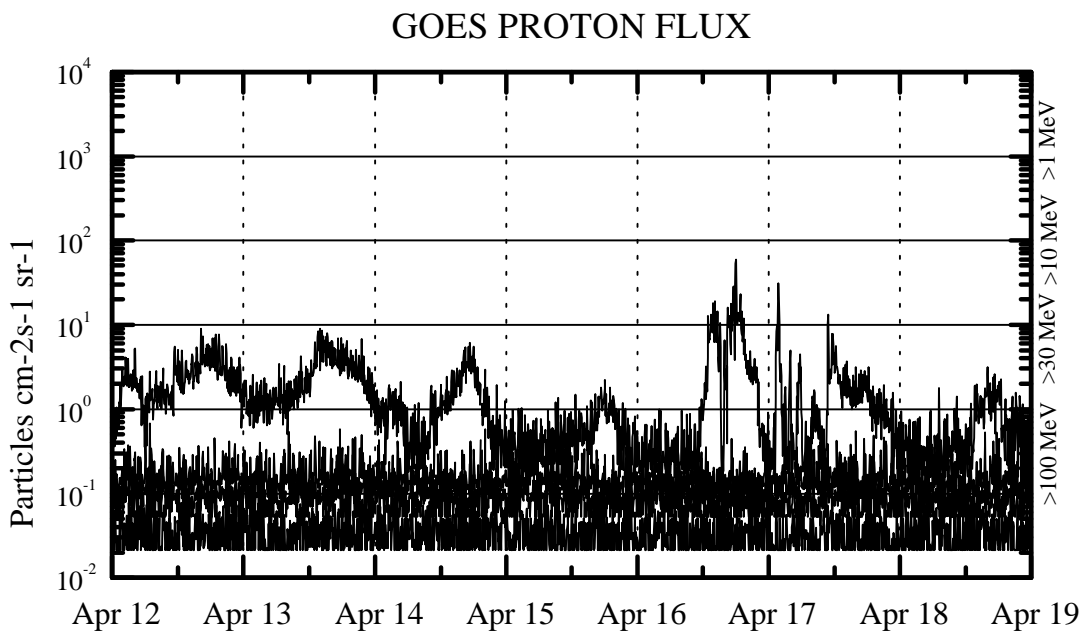
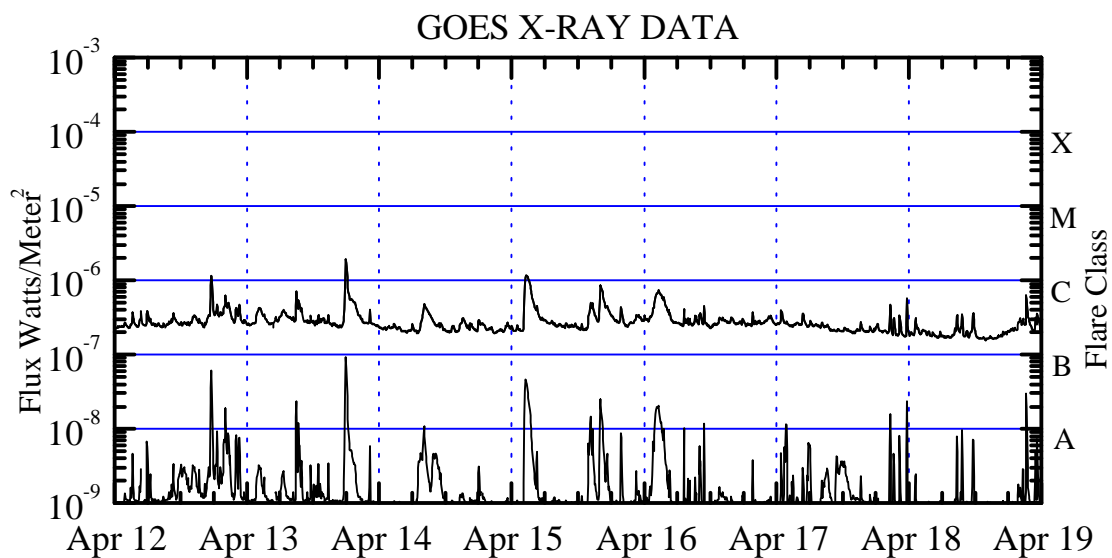
Electrons plot contains the five-minute averaged integral electron flux (electrons/ cm²-sec-sr) with energies greater than 2 MeV at GOES-8.

H_p plot contains the five minute averaged magnetic field H component in nanoteslas (nT) as measured by GOES-8. 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_p 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

X-ray plot contains five minute averaged x-ray flux (watts/m²) as measured by GOES 8 and 10 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/cm²-sec-sr) as measured by GOES-8 (W75) 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.

