

**Space Weather Highlights
25-31 May 1998**

Solar activity unexpectedly increased from low to high levels on 29 May as Region 8226 (N18, L = 208, class/area Dko/320 on 26 May) produced an M6 flare at 29/0059UT. A minor Tenflare and Types II and IV radio sweeps were detected during the flare. The region displayed minor magnetic complexity prior to the major flare, but was otherwise stable. Region 8224 (S31, L = 248, class/area Bxo/010 on 19 May) produced a long-duration C7 flare on 27 May while rounding the west limb. A well-defined post-flare loop system and a partial-halo CME were associated with the flare, which later proved to be geoeffective (see the geomagnetic activity discussion below). Activity declined to low levels on 30 May following the departure of Regions 8224 and 8226.

Solar wind data were available from the Advanced Composition Explorer (ACE) spacecraft during most of the period. Velocities ranged from 320 - 400 km/sec through 28 May, then increased to 720 km/sec on 29 May. Velocities gradually dropped from 720 - 440 km/sec during the remainder of the period. Particle densities ranged from 02 - 08 p/cc during most of the period. However, densities increased to 22 p/cc late on 26 May. Another smaller increase occurred during 29 - 30 May with densities peaking at 11 p/cc. Solar sector orientation was not readily discernible during the period. Bz hovered about zero and ranged from minus 06 to plus 08 nT (GSM) during most of the period, but became more variable on 29 May and ranged from minus 18 to plus 15 nT.

There were no significant proton enhancements observed at geosynchronous altitude.

The greater than 2 MeV electron flux at geosynchronous altitude was normal to moderate through 30 May, then increased to moderate to high levels on 31 May.

The geomagnetic field was briefly disturbed on 25 May with active to isolated minor storm periods.

The CME associated with the 27 May long-duration C7 flare intercepted the Earth around 29/1700UT. A geomagnetic field disturbance ensued with active to major storm levels detected at all latitudes. The disturbance subsided to quiet to unsettled levels by midday on 30 May.

**Space Weather Forecast
03 June 1998 – 09 June 1998**

Solar activity is expected to be low through 09 June. Probabilities for M-class flares are expected to increase after 09 June due to the expected return of old Regions 8224 and 8226.

No proton enhancements are expected at geosynchronous altitude.

The greater than 2 MeV electron flux at geosynchronous altitude is expected to be at normal to moderate levels during most of the period.

The geomagnetic field is expected to be at quiet to unsettled levels.



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
25 May	92	57	460	B2.2	0	0	0	0	0	0	0	0
26 May	93	49	550	B1.7	2	0	0	2	1	0	0	0
27 May	94	49	570	B2.7	13	0	0	26	1	0	0	0
28 May	98	47	410	C1.2	18	1	0	9	0	0	0	0
29 May	95	44	210	B8.8	9	1	0	2	0	0	0	0
30 May	96	62	230	B5.9	1	0	0	0	0	0	0	0
31 May	94	62	200	B2.7	1	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
25 May	3.6E+5	1.4E+4	3.6E+3		8.5E+6	
26 May	2.5E+5	1.5E+4	3.8E+3		1.2E+7	
27 May	1.7E+5	1.6E+4	3.8E+3		4.8E+6	
28 May	1.3E+6	1.9E+4	4.1E+3		4.9E+6	
29 May	6.7E+6	1.7E+4	4.0E+3		6.5E+6	
30 May	1.1E+6	1.5E+4	3.8E+3		2.0E+7	
31 May	3.8E+5	1.7E+4	4.1E+3		4.1E+7	

Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
25 May	10	1-1-3-3-2-2-3-3	30	2-5-6-4-3-5-2-2	15	2-1-4-3-3-4-3-3
26 May	7	3-0-0-1-2-2-3-2	10	5-1-0-0-2-2-2-2	8	3-1-1-1-2-3-3-2
27 May	6	2-2-1-1-2-2-1-2	*	4-3-1-3-*-1-1-0	7	2-2-1-2-2-3-2-2
28 May	7	1-3-1-0-1-1-3-3	*	*-5-1-0-0-1-1-2	7	1-2-1-1-2-3-2-3
29 May	21	2-2-2-2-3-6-3-4	32	4-3-2-3-4-7-3-2	19	3-3-2-2-3-6-4-3
30 May	16	4-4-4-2-2-3-2-2	*	6-4-5-*-3-4-2-2	25	5-5-5-2-3-3-2-2
31 May	4	2-1-0-1-1-1-1-2	5	2-1-2-2-1-0-2-1	7	3-2-1-2-2-2-2-1

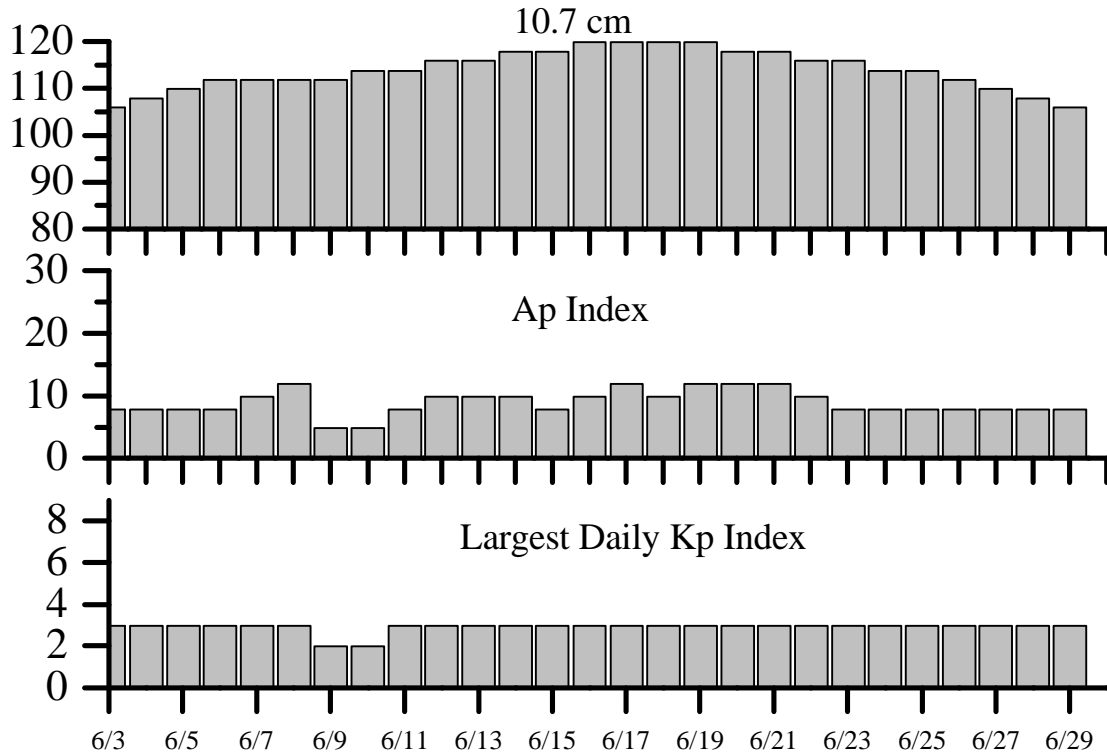


Alerts and Warnings Issued

<u>Date and Time of Issue (UT)</u>	<u>Type of Alert or Warning</u>	<u>Date and Time of Event (UT)</u>
25 May 0908	K= 4 Observed	25 May 06-09
25 May 1811	K= 4 Observed	25 May 15-18
26 May 0108	5-245 MHz Radio Bursts	25 May
28 May 0108	1-245 MHz Radio Noise Storm	25 May
27 May 1828	2695 MHz Radio Burst	27 May 1314
28 May 0116	10-245 MHz Radio Bursts	27 May
28 May 0116	1-245 MHz Radio Noise Storm	27 May
29 May 0113	Type II Radio Emission	29 May 0056
29 May 0120	2695 MHz Radio Burst	29 May 0056
29 May 0131	X-Ray event M6.7	29 May 0059
29 May 0159	Type IV Radio Emission	29 May 0110
29 May 1808	K= 6 Observed	29 May 15-18
29 May 2156	A \geq 20 Observed	29 May 2100
30 May 2106	A \geq 20 CONTINUED	29 May 2100
30 May 0909	A \geq 30 Observed	30 May 0900
30 May 2100	A \geq 30 ENDED	30 May 0900
31 May 0019	Type II Radio Emission	30 May 2249
31 May 2153	>2MeV Electron Event \geq 1000pfu	31 May 1925



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
03 June	106	8	3	17 June	120	12	3
04	108	8	3	18	120	10	3
05	110	8	3	19	120	12	3
06	112	8	3	20	118	12	3
07	112	10	3	21	118	12	3
08	112	12	3	22	116	10	3
09	112	5	2	23	116	8	3
10	114	5	2	24	114	8	3
11	114	8	3	25	114	8	3
12	116	10	3	26	112	8	3
13	116	10	3	27	110	8	3
14	118	10	3	28	108	8	3
15	118	8	3	29	106	8	3
16	120	10	3				



Energetic Events

Date	Time (UT)			X-ray		Optical Information			Peak		Sweep Freq		
	Begin	Max	½	Class	Integ	Imp	Location		Rgn	Radio Flux		Intensity	
			Max		Flux		Lat	CMD		#	245	2695	II
28 May	1343	1353	1400	M1.1	.007	SF	N18W87		8226		26		
29 May	0051	0059	0103	M6.7	.023						560	140	2 1

Flare List

Date	Time			X-ray Class.	Imp / Brtns	Optical		Rgn #
	Begin	Max	End			Location	Lat CMD	
25 May	0803	0808	0814	B3.4				
	0832	0839	0849	B5.2				
	0932	0937	0940	B6.5				
	1242	1246	1252	B7.0				
	1842	1846	1849	B3.6				
	2039	2044	2047	B3.3				
26 May	0746	0750	0754	B2.9				
	1534	1542	1558	B3.6				
	1911	1912	1916		SF	S21W70	8224	
	2032	2034	2044	C1.2	1F	N21W50	8226	
27 May	2113	2113	2117	C1.7	SF	N21W52	8226	
	0048	0052	0055	B4.2				
	0459	0505	0513	B5.2				
	0531	0534	0543	B7.9	SF	N23E65	8227	
	0609	0609	0613	C1.8	SF	N19W55	8226	
	0725	0731	0735	C1.8				
	0816	0831	0839	C1.6				
	0931	0934	0941	C1.5	SF	S23W85	8224	
	0952	0957	1008		SF	N17W64	8226	
	1052	1052	1056		SF	S23W82	8224	
	1103	1110	1116	C5.8	SF	S23W86	8224	
	1213	1217	1221	C1.8				
	1229	1232	1235		SF	S23W86	8224	
	1255	1300	1319		SF	N19W66	8226	
	1330	1335	1450	C7.5				8226
	1543	1605	1611		SF	S21W83	8224	
	1614	1619	1628		1F	S21W82	8224	
	1816	1819	1825	C5.0	SF	S20W84	8224	
1836	1837	1839	C3.8	SF	S20W83	8224		
2020	2020	2024		SF	S22W85	8224		
2043	2043	2048		SF	N19W68	8226		
2131	2134	2138	C2.1					
2225	2232	2241	C5.4					



Flare List-continued

Date	Time			X-ray Class.	Optical		Rgn #
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
27 May	2249	2249	2252		SF	S21W85	8224
	2305	2307	2321	C1.6	SF	N25E47	8227
	2343	2344	2348	C2.6	SF	S21W85	8224
28 May	0104	0104	0109	C3.3	SF	S22W86	8224
	0227	0232	0238	C3.0			
	0343	0347	0351	C1.2			
	0402	0413	0420	C2.9			
	0436	0438	0446	C3.1	SF	N20W75	8226
	0621	0622	0625	C1.2	SF	N20W78	8226
	0721	0724	0729	C1.2			
	0806	0814	0817	C1.9			
	0847	0853	0858	C2.8			
	0921	0924	0927	C1.0			8226
	1035	1040	1042	C3.2			
	1126	1126	1131	C2.3	SF	N28E39	8227
	1257	1257	1300	C2.6	SF	N22W80	8226
	1346	1349	1356	M1.1	SF	N18W87	8226
	1652	1657	1700	C1.5			
	1859	1912	1918	C8.7			8226
	2027	2029	2033	C2.2	SF	N20W80	8226
	2113	2119	2121	C2.4			
	2227	2229	2231	B9.7	SF	N20W82	8226
	2243	2252	2301	C2.2	SF	N20W83	8226
29 May	0020	0022	0030		SF	N20W81	8226
	0051	0059	0103	M6.7			
	0334	0340	0342	C4.1			
	0655	0711	0715	C4.9			
	1100	1110	1126	C4.3			
	1232	1240	1250	C1.9			
	1347	1353	1401	C2.0			
	1828	1838	1854	C1.9			
	1916	1920	1923	C1.1			
	2119	2132	2149	C2.2			
2342	2344	2354	C3.6	SF	S21E76		
30 May	1044	1048	1052	C1.0			
31 May	0353	0515	0841	C2.0			
	1802	1803	1807	B4.4	SF	S22E56	8230



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 8227</i>																		
25 May	N25E73	097	0150	05	DAO	004	B											
26 May	N24E61	096	0230	05	HKX	004	A											
27 May	N26E48	096	0280	06	HKX	006	A	1				2						
28 May	N26E35	095	0200	06	DAO	008	B	1				1						
29 May	N26E21	096	0190	05	HAX	008	A											
30 May	N26E09	095	0170	06	CAO	009	B											
31 May	N26W04	095	0130	04	DAO	008	B											
								2	0	0	0	3	0	0	0	0	0	0
Still on Disk.																		
Absolute heliographic longitude: 95																		
<i>Region 8228</i>																		
29 May	S22W13	130	0010	03	BXO	003	B											
30 May	S22W26	130	0010	02	BXO	004	B											
31 May	S22W38	129	0020	05	CSO	003	B											
								0	0	0	0	0	0	0	0	0	0	0
Still on Disk.																		
Absolute heliographic longitude: 130																		
<i>Region 8229</i>																		
29 May	S18E11	106	0010	03	BXO	003	B											
30 May	S18W02	106																
31 May	S18W15	106																
								0	0	0	0	0	0	0	0	0	0	0
Still on Disk.																		
Absolute heliographic longitude: 106																		
<i>Region 8230</i>																		
30 May	S19E60	044	0040	07	CSO	005	B											
31 May	S20E48	043	0050	09	DSO	010	B					1						
								0	0	0	0	1	0	0	0	0	0	0
Still on Disk.																		
Absolute heliographic longitude: 43																		
<i>Region 8231</i>																		
30 May	S21E33	071	0010	03	BXO	004	B											
31 May	S23E17	074	0000	00	AXX	001	A											
								0	0	0	0	0	0	0	0	0	0	0
Still on Disk.																		
Absolute heliographic longitude: 74																		



**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									
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	18.3	74.6	78.4	08	08.6
June	22.1	12.7	0.57	29.0	20.3	71.7	80.1	07	08.7*
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	25.1*	79.0	83.4*	07	08.3*
September	52.8	51.3	0.88	40.5	28.4*	96.2	85.7*	10	08.2*
October	33.6	22.8	0.68	45.4	31.9*	84.9	88.6*	11	08.3*
November	53.5	39.0	0.73	49.3	35.1*	99.5	91.4*	11	08.7*
December	57.9	41.2	0.71			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	81.8	54.8*	0.67*			109.4*		11*	
April	73.6	53.3*	0.72*			108.3*		10*	
May	74.3	56.9*	0.77*			106.6*		18*	

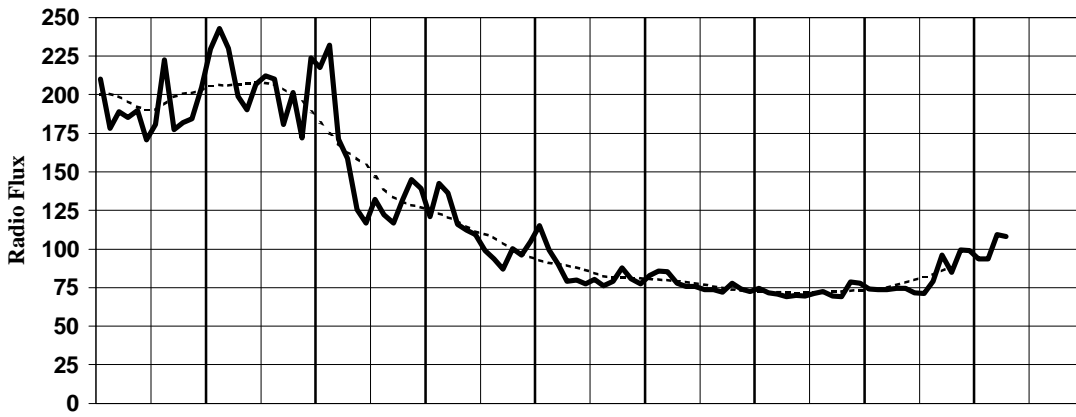
*Preliminary estimates.

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.

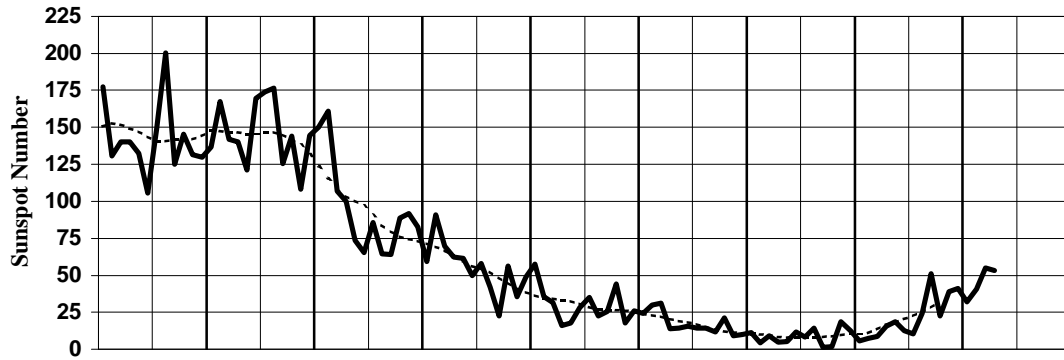
** From June 1991 onward, the 10.7 cm radio flux data source is Penticton, B.C. Canada. Prior to that, it was Ottawa.



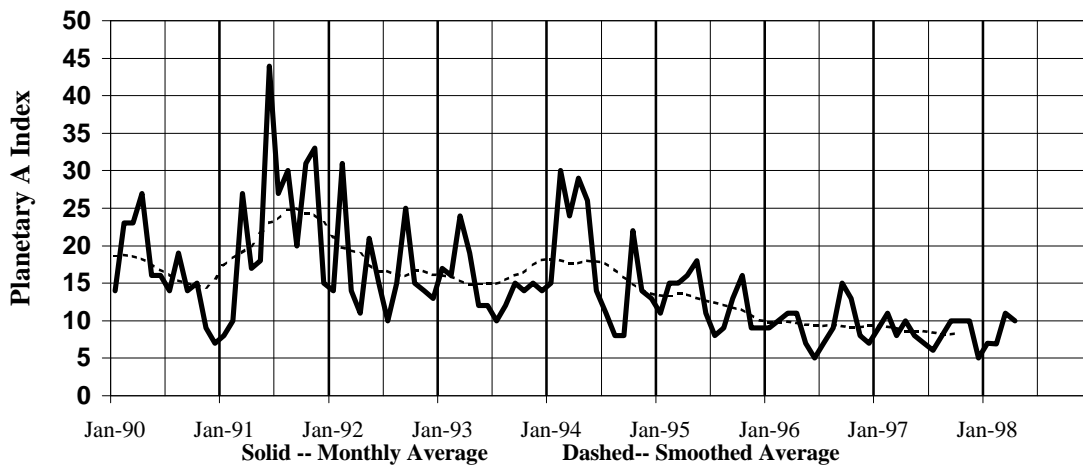
Penticton (DRAO) Radio Flux 2800MHz (10.7cm)

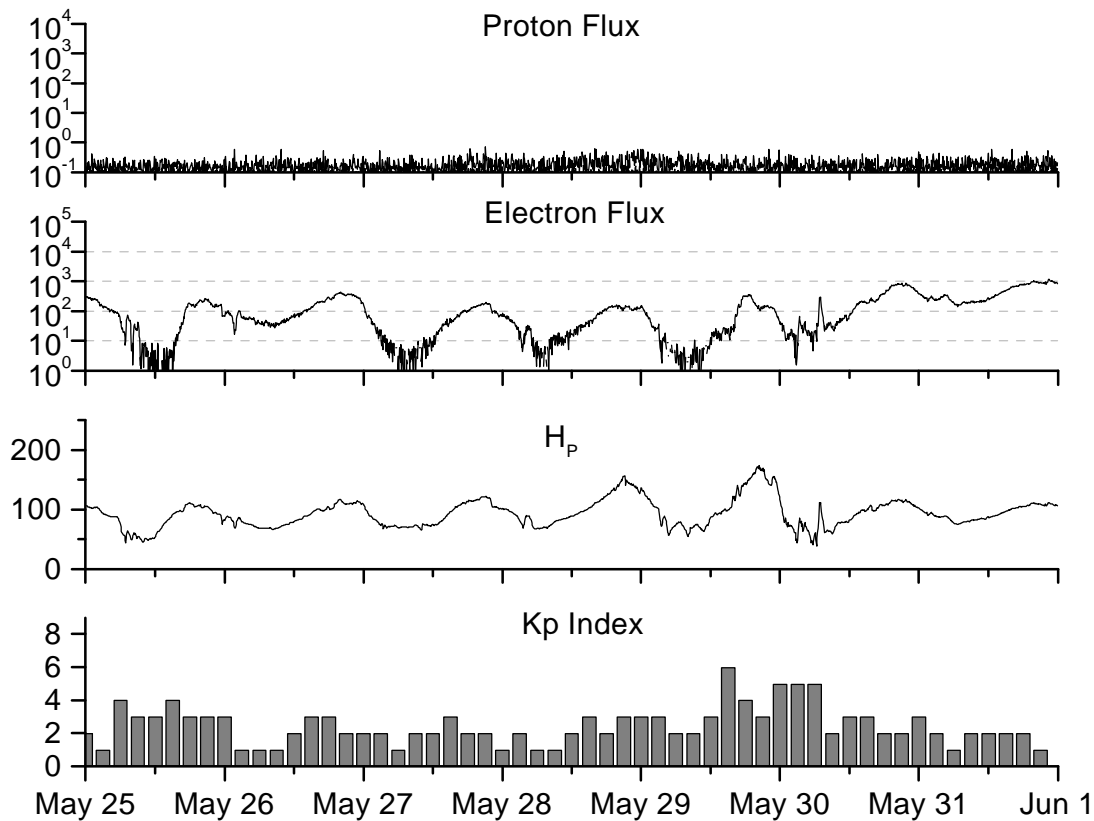


International Sunspot Number



Planetary Geomagnetic A Index (Estimated)





*Weekly Geosynchronous Satellite Environment Summary
Week Beginning 25 May 1998*

Protons plot contains the five-minute averaged integral proton flux (protons/ cm²-sec-sr) as measured by GOES-9 (W135) for each of three energy thresholds: greater than 10, 50, and 100 MeV.

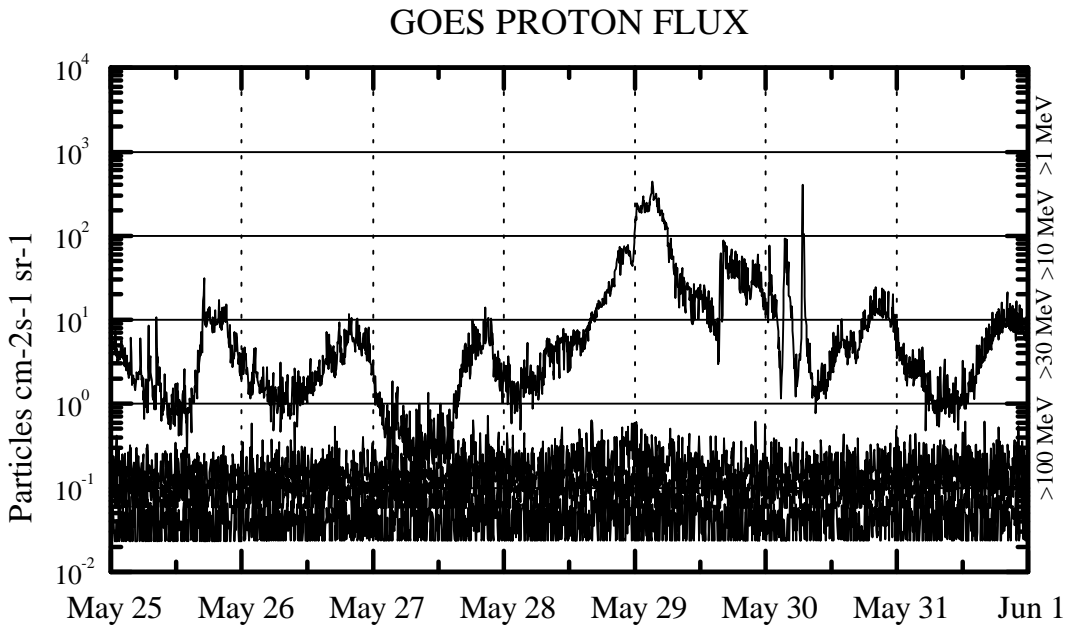
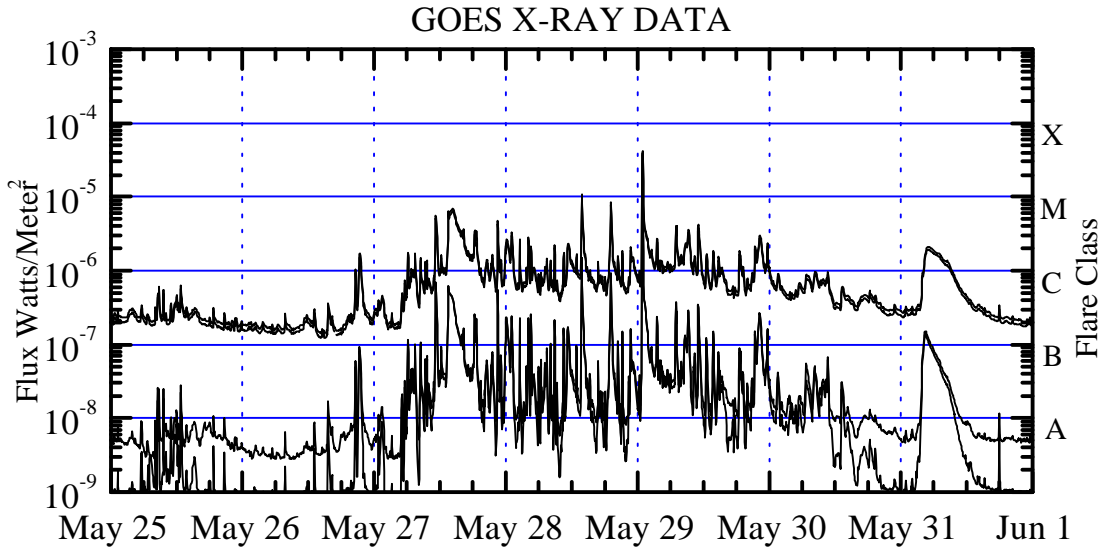
Electrons plot contains the five-minute averaged integral electron flux (electrons/ cm²-sec-sr) with energies greater than 2 MeV at GOES-9.

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.





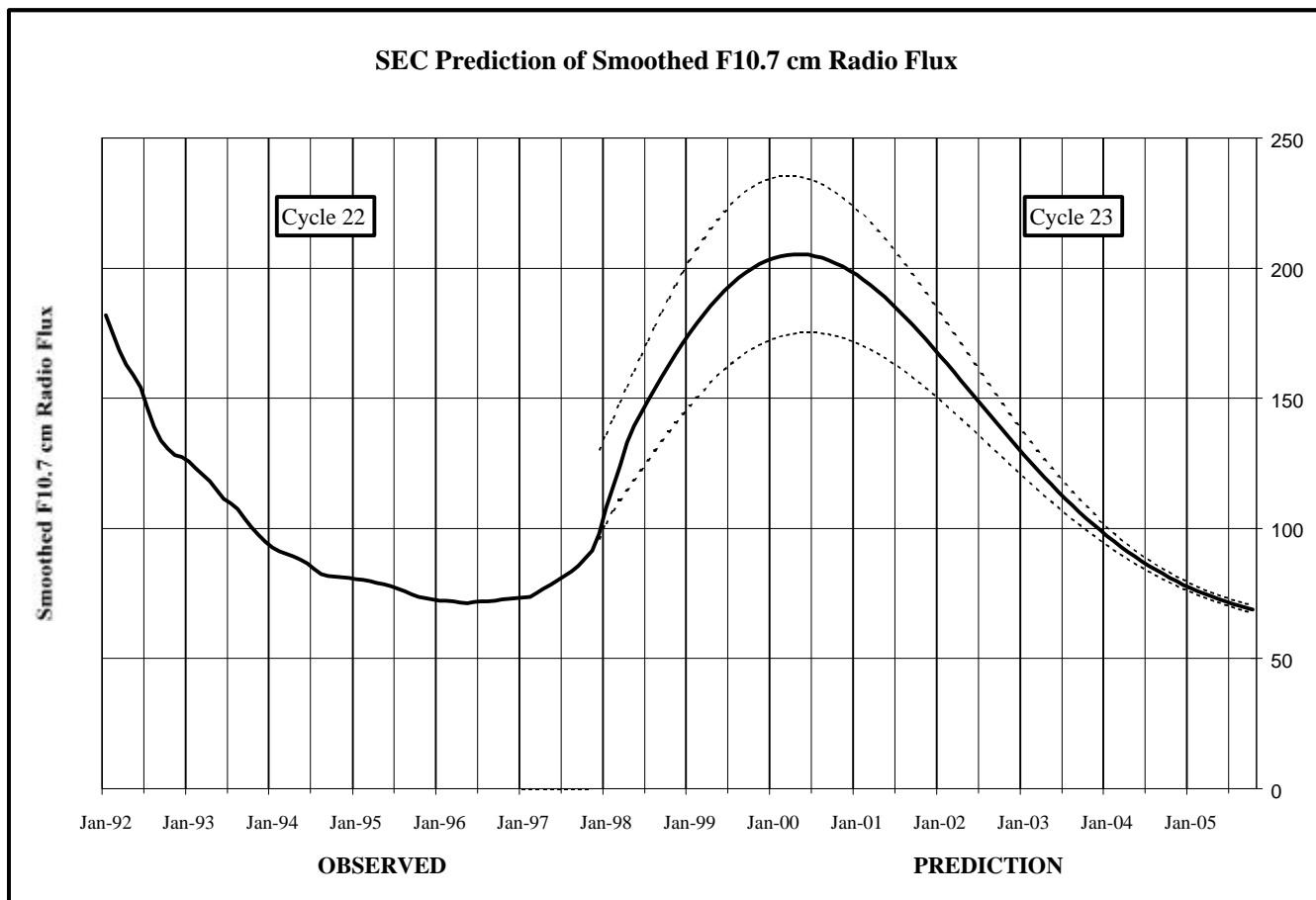
Weekly GOES Satellite X-ray and Proton Plots

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.

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.



SEC Prediction of Smoothed F10.7 cm Radio Flux

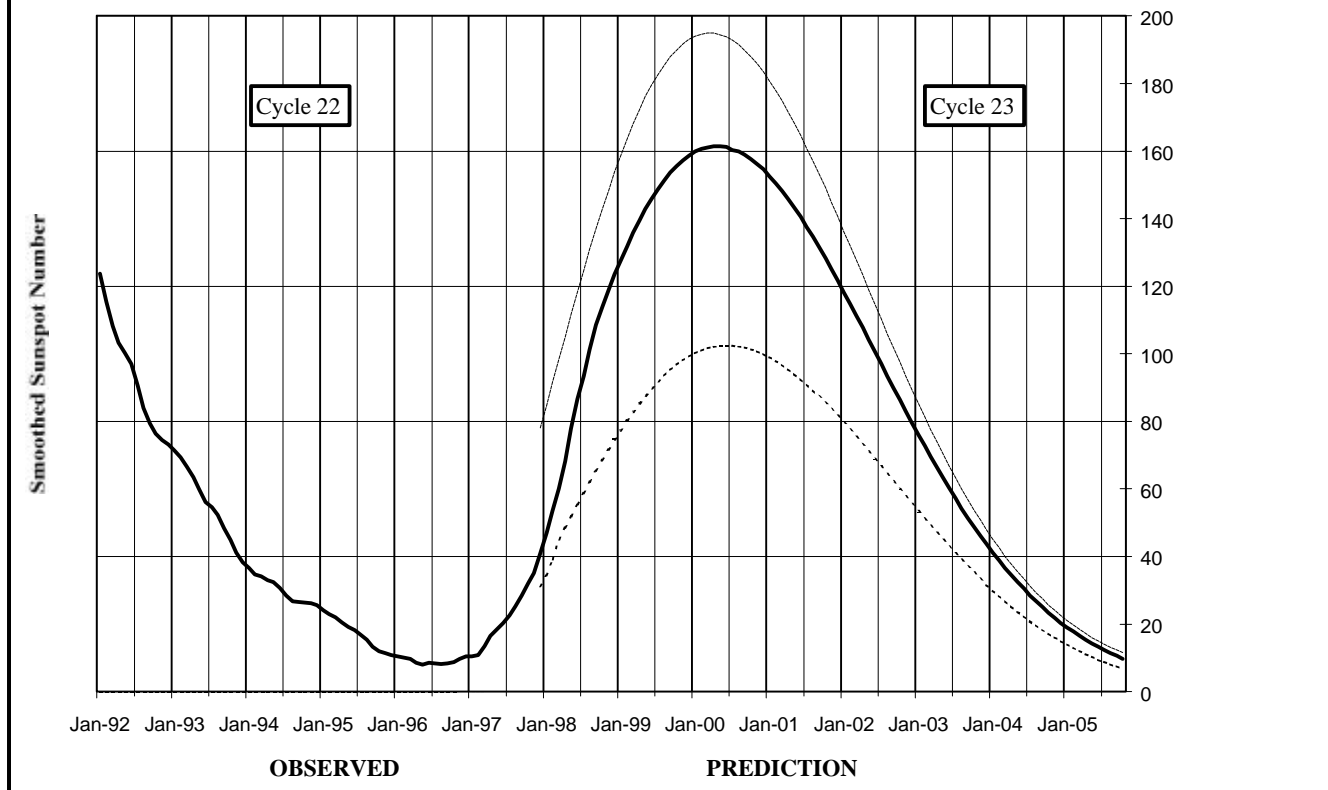


SEC Prediction of Smoothed F10.7cm Radio Flux

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1996	72 (***)	72 (***)	72 (***)	72 (***)	71 (***)	72 (***)	72 (***)	72 (***)	72 (***)	73 (***)	73 (***)	73 (***)
1997	73 (***)	74 (***)	75 (***)	77 (***)	78 (***)	80 (***)	82 (***)	83 (***)	86 (***)	89 (***)	91 (***)	98 (18)
1998	108 (18)	116 (19)	124 (20)	133 (20)	139 (21)	144 (21)	149 (22)	154 (22)	158 (23)	163 (23)	167 (23)	171 (24)
1999	175 (24)	179 (25)	182 (25)	186 (25)	189 (25)	191 (26)	194 (26)	196 (26)	198 (27)	200 (27)	202 (28)	203 (28)
2000	204 (30)	205 (30)	205 (30)	205 (30)	205 (30)	205 (28)	205 (27)	204 (27)	203 (26)	202 (26)	201 (26)	199 (26)
2001	197 (25)	195 (25)	193 (25)	191 (25)	189 (24)	186 (24)	184 (24)	181 (24)	178 (23)	175 (23)	173 (23)	170 (22)
2002	166 (22)	163 (22)	160 (21)	157 (21)	154 (21)	151 (21)	147 (20)	144 (20)	141 (19)	138 (19)	135 (18)	132 (18)
2003	129 (17)	126 (17)	123 (17)	120 (16)	117 (16)	114 (15)	112 (15)	109 (15)	106 (14)	104 (14)	102 (14)	99 (13)
2004	97 (13)	95 (13)	93 (12)	91 (12)	89 (11)	87 (10)	86 (9)	84 (9)	83 (8)	81 (7)	80 (9)	78 (9)
2005	77 (8)	76 (8)	75 (8)	74 (7)	73 (7)	72 (7)	71 (7)	70 (6)	70 (6)	69 (2)	68 (2)	68 (2)



SEC Prediction of Smoothed Sunspot Number



SEC Prediction of Smoothed Sunspot Number

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1996	10 (***)	10 (***)	10 (***)	9 (***)	8 (***)	9 (***)	9 (***)	8 (***)	9 (***)	9 (***)	10 (***)	11 (***)
1997	11 (***)	11 (***)	14 (***)	17 (***)	18 (***)	20 (***)	23 (***)	25 (***)	29 (***)	32 (***)	35 (***)	41 (20)
1998	47 (21)	54 (22)	60 (22)	68 (23)	78 (24)	87 (24)	94 (25)	101 (25)	109 (26)	114 (26)	119 (27)	124 (27)
1999	128 (27)	132 (28)	136 (28)	139 (29)	143 (29)	146 (29)	149 (29)	151 (29)	154 (29)	156 (29)	157 (29)	159 (29)
2000	160 (30)	161 (30)	161 (30)	161 (30)	161 (29)	161 (29)	160 (29)	160 (29)	159 (29)	158 (29)	156 (29)	155 (28)
2001	153 (28)	151 (28)	148 (28)	146 (27)	143 (27)	141 (27)	138 (27)	135 (26)	132 (26)	128 (26)	125 (25)	122 (25)
2002	119 (24)	115 (24)	111 (24)	108 (23)	104 (23)	101 (22)	97 (22)	94 (21)	90 (21)	86 (21)	83 (20)	80 (20)
2003	76 (19)	73 (19)	70 (18)	66 (18)	63 (17)	60 (17)	57 (17)	54 (16)	52 (16)	49 (15)	46 (15)	44 (14)
2004	41 (14)	39 (14)	37 (13)	35 (13)	32 (12)	31 (12)	29 (11)	27 (11)	25 (11)	23 (10)	22 (10)	20 (9)
2005	19 (9)	18 (9)	17 (8)	15 (8)	14 (8)	13 (8)	12 (7)	11 (7)	11 (7)	10 (6)	9 (5)	8 (4)

