

**Space Weather Highlights
09-15 March 1998**

Solar activity ranged from very low to moderate. Region 8179 (S22, L = 032, class/area Ekc/800 on 16 March) produced three M-class flares: an M1/1F at 15/1616UT, an M1/1B at 15/1920UT, and an M2/SF at 15/2146UT. There were minor discrete radio emissions associated with the latter two flares. The SOHO/LASCO instrument detected a partial-halo coronal mass ejection (CME) departing the southeast limb around the time of the 15/1920UT M1/SF flare. Region 8179 produced the M-class flares during a period of dramatic growth that began late on 13 March and continued through the end of the period.

Solar wind data were available from the WIND spacecraft during most of the period. Velocities increased from 260 - 570 km/sec during 10 March, then averaged around 550 km/sec through 12 March. Velocities gradually decreased to from 550 - 350 km/sec during 13 - 15 March. Densities were elevated during 09 - 10 March, peaking near 40 p/cc, then dropped to a range of 02 - 09 p/cc during 11 - 13 March. Densities gradually increased from 02 - 10 p/cc during the last two days. Bz was generally in the plus to minus 07 nT (GSM) range, but varied from plus 14 to minus 18 nT during 10 March. Solar sector orientation was mostly away (phi angle near 135 degrees) on 09 March, then shifted to mostly toward conditions during the rest of the period.

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 beginning 11/1458UT.

The geomagnetic field was quiet through 10/0600UT. A disturbance began after 10/0600UT March and continued through the 11th with active to (brief) major storm levels detected at all latitudes and active to (brief) severe storm levels detected at high latitudes. The field declined to mostly quiet to unsettled levels during the rest of the period with isolated active reported at all latitudes and isolated minor storm levels at high latitudes.

**Space Weather Forecast
18 March 1998 - 13 April 1998**

Solar activity is expected to range from very low to moderate. Region 8179 may produce M-class flares before rounding the limb on 22 March. Very low to low activity is expected during 23 March - 03 April with isolated C-class flares the rule. Activity is expected to return to low to moderate levels with the return of (old) Region 8179 on 04 April.

No significant proton enhancements are expected at geosynchronous altitude.

The greater than 2 MeV electron flux at geosynchronous altitude is expected to be normal during most of the period. However, fluxes are expected to be at moderate to high levels through 24 March and again during 07 - 09 April.

The geomagnetic field is expected to be at quiet to unsettled levels during most of the period. However, active to minor storm conditions are possible during 19 - 22 March in response to CME occurrences. Active to minor storm conditions are also possible around 06 - 07 April due to a recurrent coronal hole high speed windstream.



Daily Solar Data

Date	Radio Flux	Sun spot	Sunspot Area	X-ray Background	X-ray Flux			Flares				
	10.7 cm	No. (10 ⁶ hemi.)			C	M	X	S	1	2	3	4
09 March	90	49	150	B1.6	1	0	0	3	0	0	0	0
10 March	96	75	280	B1.7	0	0	0	0	0	0	0	0
11 March	101	83	370	B1.2	0	0	0	3	0	0	0	0
12 March	102	114	300	B2.1	1	0	0	0	0	0	0	0
13 March	105	115	360	B1.4	1	0	0	5	0	0	0	0
14 March	120	119	420	B2.5	3	0	0	7	0	0	0	0
15 March	133	110	900	B4.8	9	3	0	11	3	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
09 March	1.1E+5	1.8E+4	4.2E+3		2.1E+5	
10 March	7.7E+5	1.7E+4	4.2E+3		2.7E+5	
11 March	6.9E+6	1.7E+4	4.0E+3		1.8E+8	
12 March	2.5E+6	1.8E+4	4.2E+3		4.4E+8	
13 March	2.0E+6	1.7E+4	4.2E+3		8.5E+8	
14 March	1.7E+6	1.8E+4	4.2E+3		1.3E+9	
15 March	5.3E+5	1.7E+4	4.0E+3		6.7E+7	

Daily Geomagnetic Data

Date	Middle Latitude		High Latitude		Estimated	
	Fredericksburg		College		Planetary	
	A	K-indices	A	K-indices	A	K-indices
09 March	1	0-0-1-1-1-0-0-0	*	*_*_*_*_*_*_*_*_*	3	0-0-1-1-2-1-1-1
10 March	23	1-2-3-5-3-3-5-4	*	0-0-5-6-4-*-5-4	25	1-2-4-5-4-5-5-5
11 March	20	4-4-4-4-2-3-2-3	42	3-4-6-6-5-5-1-4	28	4-4-6-5-3-3-2-4
12 March	8	3-3-2-2-2-1-2-1	26	4-4-4-5-5-3-2-1	12	3-3-4-3-2-2-3-2
13 March	12	3-3-3-2-2-3-2-3	23	2-2-3-6-4-4-2-2	13	2-3-3-4-2-3-2-3
14 March	8	1-1-2-2-2-3-2-3	22	2-1-4-3-5-5-2-3	10	2-1-2-2-3-3-3-3
15 March	12	4-3-4-1-2-1-1-2	28	4-4-5-5-5-2-2-2	18	5-4-5-2-3-2-2-3

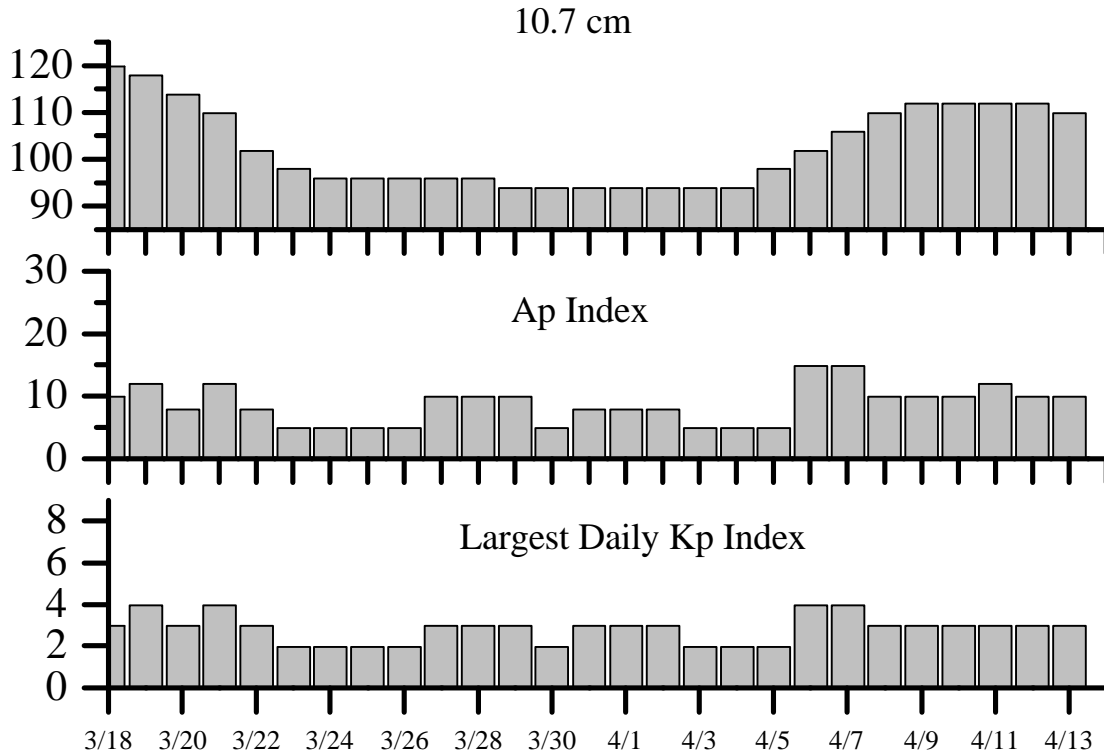


Alerts and Warnings Issued

Date and Time of Issue (UT)	Type of Alert or Warning	Date and Time of Event (UT)
10 Mar 0926	K= 4 Observed	10 Mar 06 -09
10 Mar 1209	K= 6 Observed	10 Mar 09 -12
10 Mar 1537	A \geq 20 Observed	10 Mar 15:00
10 Mar 1814	K= 5 Observed	10 Mar 15-18
10 Mar 1952	A \geq 20 Watch	11 Mar
10 Mar 2110	A \geq 30 Observed	10 Mar 2100
11 Mar 1523	>2MeV Electron Event \geq 1000pfu	11 Mar 1458
12 Mar 0003	A \geq 20 continues	12 Mar 0002
12 Mar 0006	A \geq 30 ends	11 Mar 1800
12 Mar 0006	K= 4 Observed	11 Mar 21-24
12 Mar 0112	1-245MHz Radio Burst	10 Mar 2039
13 Mar 0005	>2MeV Electron Event in Progress \geq 1000pfu	12 Mar 2359
13 Mar 0601	K= 4 Observed	13 Mar 03 -06
13 Mar 2359	>2MeV Electron Event in Progress \geq 1000pfu	13 Mar
15 Mar 0007	>2MeV Electron Event in Progress \geq 1000pfu	14 Mar
15 Mar 0245	K= 5 Observed	15 Mar 00-03
15 Mar 0317	Sudden Impulse observed at Boulder	15 Mar 0210
15 Mar 0840	A \geq 20 Watch	15 Mar



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
18 Mar	120	10	3	01 Apr	94	8	3
19	118	12	4	02	94	8	3
20	114	8	3	03	94	5	2
21	110	12	4	04	94	5	2
22	102	8	3	05	98	5	2
23	98	5	2	06	102	15	4
24	96	5	2	07	106	15	4
25	96	5	2	08	110	10	3
26	96	5	2	09	112	10	3
27	96	10	3	10	112	10	3
28	96	10	3	11	112	12	3
29	94	10	3	12	112	10	3
30	94	5	2	13	110	10	3
31	94	8	3				



Energetic Events

Date	Time (UT)			X-ray		Optical Information			Peak		Sweep Freq		
	Begin	Max	½	Class	Integ	Imp Brtns	Location		Rgn #	Radio Flux		Intensity	
			Max		Flux		Lat	CMD		245	2695	II	IV
15 Mar	1604	1616	1626	M1.0	.009	1F	S23W03		8179				
15 Mar	1911	1920	1927	M1.8	.010	1B	S21W03		8179	35			
15 Mar	2141	2146	2150	M2.7	.009								

Flare List

Date	Time			X-ray Class.	Optical		Rgn #
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
09 March	0004	0008	0011	B3.2			
	0127	0135	0141	B3.2			
	0427	0430	0432	B3.2			
	0457	0458	0501	B6.0	SF	S42E51	8176
	0753	0757	0801	B2.6			
	1245	1258	1307	C1.1			
	1652	1656	1700	B5.6			8176
	2008	2014	2020	B3.1			
10 March	2155	2205	2224	B4.1			
	2327	2330	2332	B4.7	SF	S42E41	8176
	0306	0310	0315	B2.1			
	0414	0417	0419	B6.5			
	0542	0552	0604	B2.9			
	0639	0643	0650	B2.8			
	0749	0754	0801	B3.8			
	0828	0832	0836	B3.2			
	1003	1008	1014	B3.2			
	1332	1451	1517	B3.2			
11 March	1100	1106	1117	B2.8			
	1446	1448	1453	B5.0	SF	S27E56	8179
	1527	1531	1534		SF	S41E20	8176
	1542	1546	1557	B7.3			8179
	1706	1711	1716	B3.4			
	2133	2138	2154	B6.3	SF	S42E18	8176
12 March	2333	2337	2343	B4.1			
	0039	0045	0059	B3.5			
	0114	0122	0131	C1.0			
	0456	0501	0506	B3.7			
	0546	0550	0553	B3.7			
	0748	0755	0800	B5.6			
	1335	1338	1349	B1.9			
	1506	1514	1522	B2.8			
	2301	2309	2322	B2.7			



Flare List – continued.

Date	Time			X-ray Class.	Optical		Rgn #
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
13 March	0424	0429	0435	B2.4			
	0739	0742	0744	B2.9			
	0807	0811	0817	B5.2			
	B1058	U1058	1110		SF	S18W76	8173
	1112	1151	1207	B5.8			
	1129	1132	1134	B3.4			
	1547	1548	1551		SF	S29E35	8180
	2051	2111	2117	C5.8	SF	S16W83	8173
	2153	2156	2159	B8.8			
	2206	2209	2215		SF	S24E29	8179
	2239	2239	A2302		SF	N18E62	
14 March	1117	1118	1141	C1.1	SF	S23E15	8179
	1147	1152	1156	C2.2			
	1446	1448	1503	C1.4	SF	S21E16	8179
	1625	1625	1629	B8.3	SF	S23E13	8179
	1718	1732	1737	B6.8	SF	S23E13	8179
	1753	1753	1801		SF	S22E12	8179
	1811	1811	1829		SF	S22E11	8179
	1841	1844	1846	B6.6			
	1856	1858	1906		SF	S22E11	8179
	2157	2201	2203	B8.3			
15 March	0121	0122	0124	B9.3	SF	S28E10	8179
	0145	0149	0152	C1.6			
	0315	0317	0319		SF	S28E09	8179
	0342	0349	0352		1F	S28E09	8179
	0427	0433	0436	C1.2			
	0547	0550	0553	B6.8			
	0610	0614	0622	B7.2			
	0725	0729	0731	C1.1			
	0846	0850	0853	B9.3			
	B1109	U1110	1118		SF	S21E03	8179
	B1154	1154	1207	C2.1	SF	S20E00	8179
	1309	1310	1315	C1.6	SF	S23W01	8179
	1441	1442	1539		SF	S23E03	8179
	1606	1616	1720	M1.0	1F	S23W03	8179
	B1636	1706	A1655		SF	S22W01	8179
1736	1747	1759	C7.5	SF	S23W01	8179	
1834	1838	1844	C1.7				
1913	1921	1943	M1.8	1B	S21W03	8179	



Flare List – continued.

Date	Time			X-ray Class.	Imp / Brtns	Optical	Rgn #
	Begin	Max	End			Location Lat CMD	
15 March	1955	2001	2008		SF	S23W06	8179
	2016	2032	2040	C3.4			
	2111	2111	2118		SF	S25E01	8179
	2141	2146	2150	M2.7			
	2155	2247	A2301	C5.0	SF	S23W01	8179

Region Summary

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 4

Region 8173

01 Mar	S17E71	142	0000	00	AXX	001	A									
02 Mar	S17E57	142	0010	00	AXX	001	A									
03 Mar	S15E43	143	0000	00	AXX	001	A									
04 Mar	S16E29	144	0000	00	AXX	001	A									
05 Mar	S16E16	144														
06 Mar	S18E10	137	0010	02	BXO	002	B									
07 Mar	S18W03	137														
08 Mar	S18W16	137														
09 Mar	S18W29	137														
10 Mar	S18W42	137														
11 Mar	S18W55	137														
12 Mar	S18W68	137														
13 Mar	S19W83	137	0010	04	BXO	003	B	1			2					
								1	0	0	2	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude: 137



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

Region 8174

06 Mar	S17E50	097	0010	02	BXO	002	B										
07 Mar	S17E37	098	0040	05	CRO	006	B										
08 Mar	S19E25	095	0050	07	CSO	008	B										
09 Mar	S17E11	096	0050	08	DSO	009	B										
10 Mar	S18W01	095	0030	07	CSO	006	B										
11 Mar	S18W16	097	0030	05	CRO	005	B										
12 Mar	S17W31	099	0000	05	BXO	002	B										
13 Mar	S17W44	098	0000	00	AXX	001	A										
14 Mar	S17W58	099	0000	00	AXX	001	A										
15 Mar	S17W71	099															

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 095

Region 8175

07 Mar	N44E56	079	0010	01	AXX	002	A										
08 Mar	N45E46	074	0040	02	HAX	001	A										
09 Mar	N47E33	074	0050	03	HSX	001	A										
10 Mar	N47E23	071	0030	01	HSX	001	A										
11 Mar	N47E12	069	0030	01	HRX	001	A										
12 Mar	N47E00	068	0020	01	HRX	001	A										
13 Mar	N47W13	067	0000	00	AXX	001	A										
14 Mar	N48W24	065	0010	01	AXX	001	A										
15 Mar	N47W37	065	0000	00	AXX	001	A										

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 068



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 8176</i>																					
07 Mar	S43E66	069	0000	01	AXX	001	A														
08 Mar	S42E54	066	0030	06	BXO	006	B													1	
09 Mar	S40E41	066	0050	09	CAO	007	B													3	
10 Mar	S39E29	065	0110	09	DAO	014	B														
11 Mar	S38E17	064	0140	11	EAO	021	B													2	
12 Mar	S40E05	063	0140	13	EAO	025	B														
13 Mar	S40W07	061	0210	14	EAI	020	B														
14 Mar	S39W22	063	0150	12	EAO	015	B														
15 Mar	S38W34	062	0100	13	ESO	012	B														
																					0 0 0 6 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 063

Region 8177

08 Mar	S33W21	141	0010	03	BXO	002	B														
09 Mar	S33W34	141																			
10 Mar	S33W47	141																			
11 Mar	S33W60	141																			
																					0 0 0 0 0 0 0 0

Died on Disk.

Absolute heliographic longitude: 141

Region 8178

10 Mar	S15E72	022	0100	04	HSX	001	A														
11 Mar	S16E59	022	0140	01	HSX	001	A														
12 Mar	S17E47	021	0100	01	HSX	001	A														
13 Mar	S16E34	020	0110	02	HSX	001	A														
14 Mar	S17E20	021	0110	02	HSX	001	A														
15 Mar	S16E07	021	0130	02	HSX	001	A														
																					0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 021



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 8179</i>																		
10 Mar	S22E60	034	0010	04	BXO	003	B											
11 Mar	S23E50	031	0030	09	CRO	005	B					1						
12 Mar	S24E36	032	0030	10	CRO	008	B											
13 Mar	S22E22	032	0020	07	BXO	013	B					1						
14 Mar	S22E08	033	0140	09	DAC	038	BG	2				7						
15 Mar	S22W04	032	0670	11	EKC	045	BGD	4	2			11	3					
								6	2	0		20	3	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 032

Region 8180

12 Mar	S29E42	026	0010	05	BXO	005	B											
13 Mar	S27E29	025	0010	07	BXO	006	B					1						
14 Mar	S30E19	022	0010	03	BXO	003	B											
15 Mar	S30E07	021	0000	00	AXX	001	A											
								0	0	0		1	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 021

Region 8181

12 Mar	S20E48	020	0000	04	BXO	002	B											
13 Mar	S20E35	020																
15 Mar	S20E09	020																
								0	0	0		0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 020



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

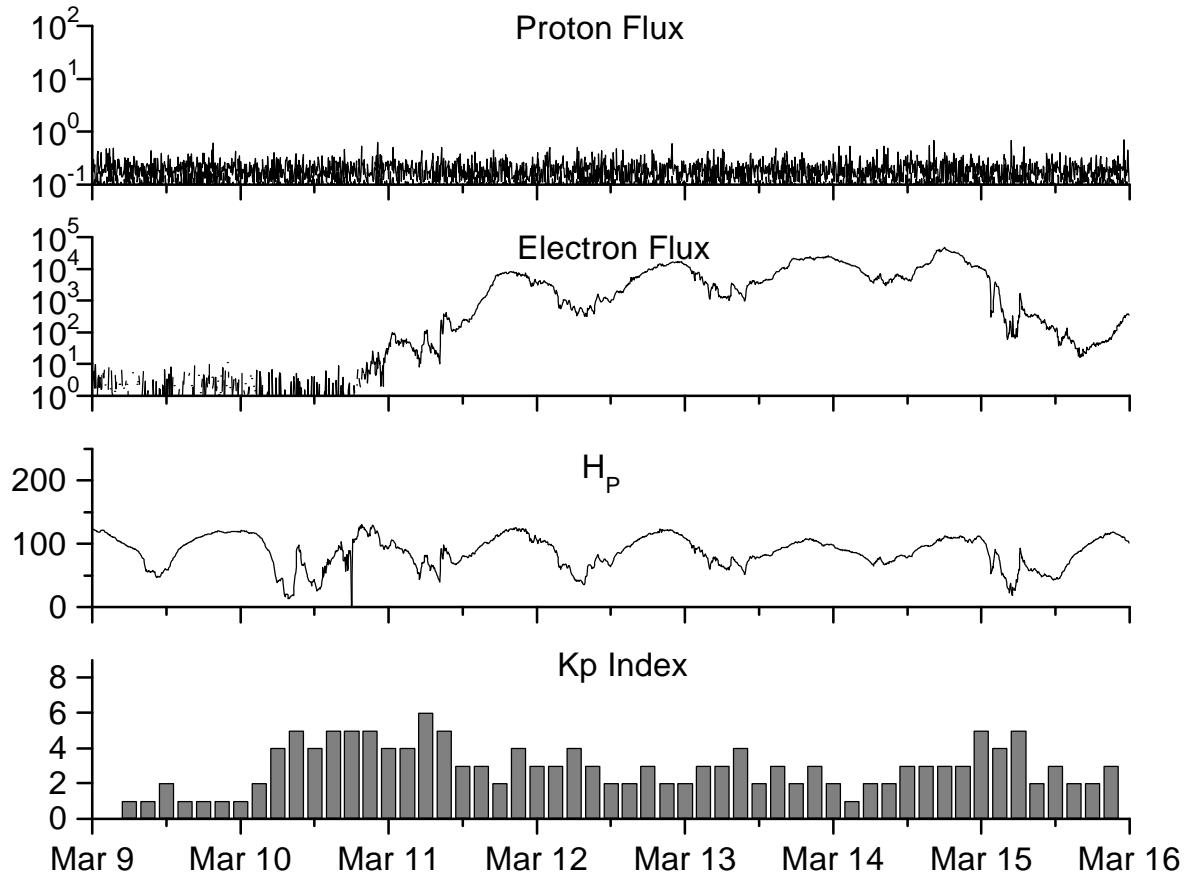
Month	Sunspot Numbers					Radio Flux		Geomagnetic	
	Observed SWO	values RI	Ratio RI/SWO	Smooth SWO	values RI	**Penticton 10.7 cm	Smooth Value	Planetary Ap	Smooth Value
1996									
March	12.1	09.2	0.76	15.4	09.7	72.7	72.1	11	09.9
April	08.5	04.8	0.56	13.6	08.5	69.3	71.6	11	09.7
May	11.8	05.5	0.47	12.9	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	09.0*
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	08.6*
July	17.0	10.5*	0.62*	32.4	22.7*	71.1	81.8*	06*	08.4*
August	36.7	24.7*	0.67*	35.9	25.2*	79.0	83.4*	08*	08.2*
September	52.8	51.3*	0.88*			96.2*		10*	
October	33.6	23.3*	0.69*			85.0*		10*	
November	53.5	39.3*	0.73*			99.5*		10*	
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*	

*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 09 March 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.

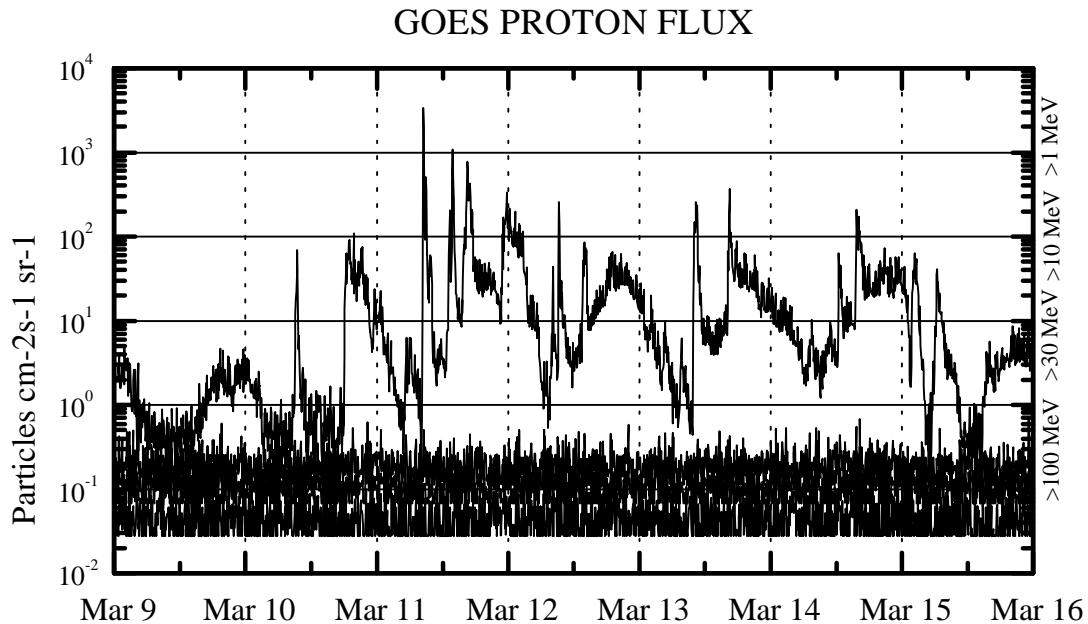
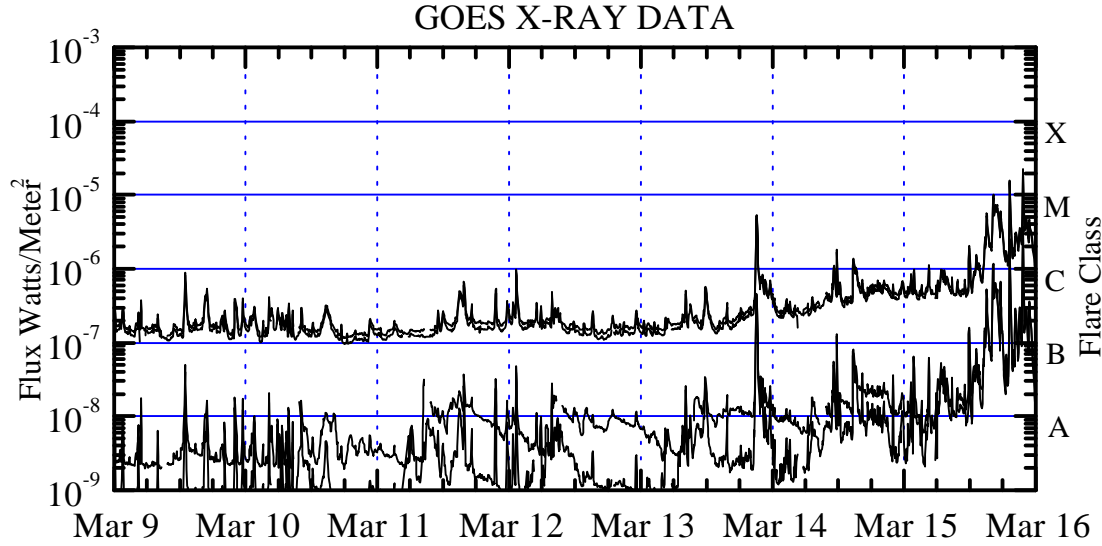
Electrons plot contains the five-minute averaged integral electron flux (electrons/ cm² -sec-sr) with energies greater than 2 MeV at GOES-9.

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_{parallel} 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.

