

**Space Weather Highlights**  
**08-14 March 1999**

Solar activity varied from low to moderate levels. The week began with activity at moderate levels, by virtue of an isolated M2/SF flare from Region 8484 (S23, L = 259, class/area Dao/120 on 11 March) at 08/0637UT with an associated Type II radio sweep. Region 8484 gradually declined through the rest of the period. Activity dropped to low levels during 09 - 12 March. A 45-degree filament, last seen centered near S53E06, disappeared on 10 March. Activity increased to moderate levels during 13 - 14 March as Region 8487 (N17, L = 240, class/area Eai/200 on 15 March) produced three low-level M-class flares: an M1/SF at 13/2034UT, an M2/1N at 14/0127UT, and an M1/SF at 14/1010UT; all of which had minor radio emission. SOHO/LASCO images showed a partial-halo CME that was associated with the 14/1010UT flare. Region 8487 grew slowly as it produced these flares and showed moderate to strong magnetic gradients near region center. Region 8485 (N23, L = 277, class/area Fki/560 on 14 March) was the largest and most magnetically complex group on the disk, but produced only B- and C-class flares.

Real-time solar wind data were available from the Advanced Composition Explorer (ACE) spacecraft during most of the period. There were two periods of interest. The first was a CME passage detected during 09 - 10 March with enhanced particle densities and periods of sustained southward IMF Bz (maximum deflections to minus 12 nT (GSM). The second period of interest began during the latter half of 14 March as a high-speed coronal hole windstream began to affect the Earth's field. These effects included a velocity increase from 380 - 630 km/sec and southward IMF Bz deflections to minus 09 nT. An isolated, positive-polarity northern-hemispheric hole (possibly recurrent) appeared to be the source of the high-speed stream.

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

The greater than 2 MeV electron flux at geosynchronous altitude was at normal to moderate levels during most of the period, but briefly rose to high levels on 09 March.

Geomagnetic field activity varied from quiet to unsettled levels on 08 March. Field activity increased during 09 - 10 March (in response to a CME passage) with active to minor storm periods detected at all latitudes and isolated major storm episodes at high latitudes. Activity declined to mostly quiet to unsettled levels during 11 - 14 March with brief active periods reported at some high latitude stations.

**Space Weather Outlook**  
**17 March 1999 -12 April 1999**

Solar activity is expected to be low to moderate. Isolated M-class flares are possible during 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 moderate levels during most of the period. However, fluxes may reach high levels during 29 March - 03 April.

Geomagnetic field activity may increase to active levels during 17 - 18 March due to CME effects. Active conditions are also possible during 28 March - 01 April and 10 - 11 April due to recurrent coronal hole effects.



**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
08 March	127	107	530	B3.5	1	1	0	2	0	0	0	0
09 March	127	89	520	B3.9	4	0	0	5	2	0	0	0
10 March	135	88	590	B3.7	4	0	0	10	0	0	0	0
11 March	137	95	700	B3.3	8	0	0	23	0	0	0	0
12 March	140	98	730	B5.0	11	0	0	22	2	0	0	0
13 March	144	107	760	B5.2	7	1	0	18	0	0	0	0
14 March	150	131	970	B6.0	3	2	0	12	1	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
08 March	8.3E+4	1.5E+4	3.9E+3		3.0E+7	
09 March	6.0E+5	1.6E+4	3.8E+3		2.4E+7	
10 March	1.1E+6	1.6E+4	4.1E+3		5.3E+6	
11 March	2.1E+5	1.5E+4	3.7E+3		4.4E+6	
12 March	1.7E+5	1.4E+4	3.2E+3		2.7E+6	
13 March	1.7E+5	1.4E+4	3.2E+3		4.0E+6	
14 March	2.7E+5	1.5E+4	3.2E+3		4.1E+6	

**Daily Geomagnetic Data**

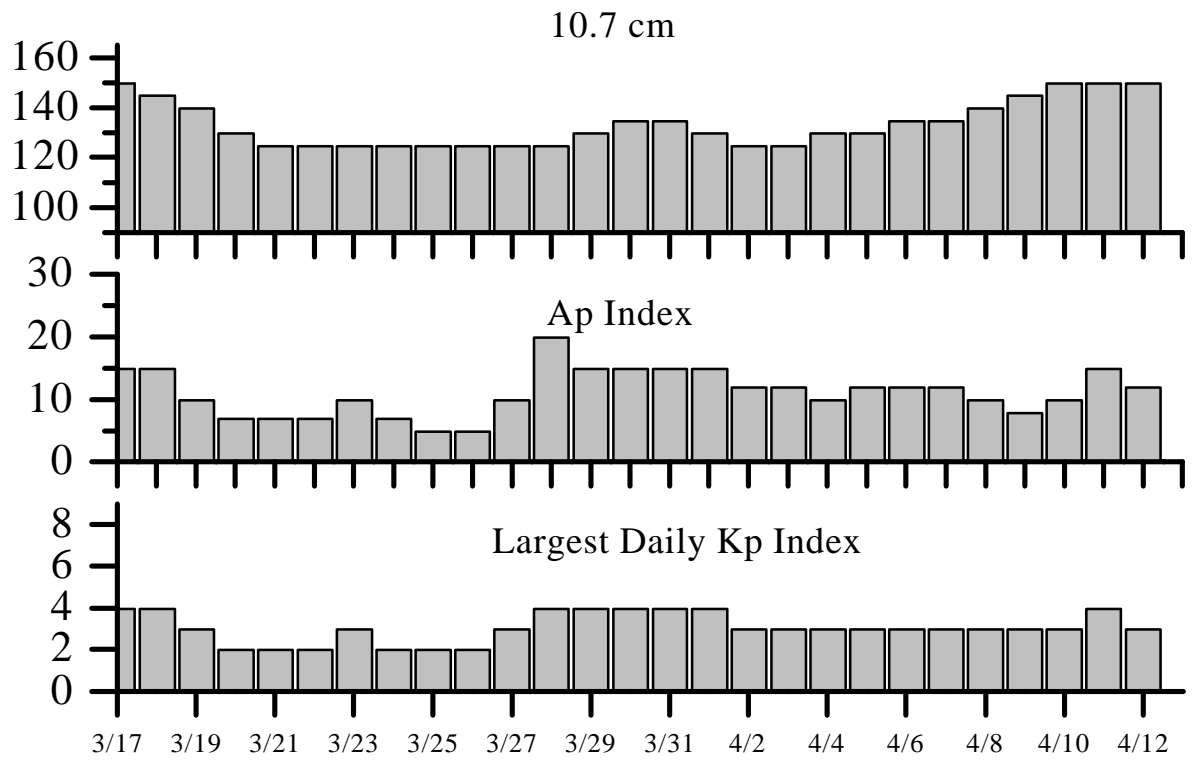
Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	08 March	8	3-3-1-1-1-1-2-3	10	2-2-3-3-3-2-2-2	10
09 March	19	4-3-4-3-4-2-2-4	*	3-3-5-6-6-4-**-*	23	4-4-4-5-5-3-3-3
10 March	29	5-6-5-4-2-2-2-2	*	*-**-**-**-**-*	31	4-6-5-5-3-3-3-2
11 March	12	3-3-3-3-3-2-2-2	*	*-**-**-**-**-*	13	3-3-3-3-4-3-3-1
12 March	9	1-2-2-3-2-2-3-2	17	1-2-4-5-4-2-2-2	10	1-2-3-4-3-2-3-2
13 March	4	2-0-0-1-3-1-0-2	8	1-0-0-2-5-1-1-1	7	1-1-1-1-4-2-2-3
14 March	12	2-2-1-3-4-3-2-3	*	*-2-*-4-5-2-3-2	13	2-3-1-3-4-3-3-3



*Alerts and Warnings Issued*

Date and Time of Issue (UT)	Type of Alert or Warning	Date and Time of Event (UT)
08 Mar 0304	K= 4 Observed	08 Mar 00 - 03
08 Mar 0600	K= 4 Observed	08 Mar 03 - 06
09 Mar 0008	2-245 MHz Bursts	08 Mar
09 Mar 0020	Type II Radio Emission	08 Mar 0638
09 Mar 0600	K= 4 Observed	09 Mar 03 - 06
09 Mar 0902	K= 5 Observed	09 Mar 06 - 09
09 Mar 0902	K= 5 Warning valid from	09 Mar 09 - 15
09 Mar 1116	A $\geq$ 20 Watch	09 Mar
09 Mar 1200	A $\geq$ 20 Observed	09 Mar 1200
09 Mar 1428	>2MeV Electron Event $\geq$ 1000pfu	09 Mar 1410
09 Mar 1800	K= 4 Observed	09 Mar 15-18
10 Mar 0235	5-245 MHz Burst	09 Mar
10 Mar 0159	Sudden Impulse 13 nT	10 Mar 0130
10 Mar 0228	K= 5 Warning valid	10 Mar 0227 - 1200
10 Mar 0300	A $\geq$ 30 Observed	10 Mar 0300
10 Mar 0300	K= 5 Observed	10 Mar 00-03
10 Mar 0600	K= 6 Observed	10 Mar 03 - 06
10 Mar 1200	CONTINUED >2MeV Electron Event $\geq$ 1000pfu	09 Mar 1410
12 Mar 0013	2-245 MHz Bursts	11 Mar
12 Mar 1159	K= 4 Observed	12 Mar 09 - 12
12 Mar 1740	A $\geq$ 20 Watch	14 Mar
12 Mar 2018	Type IV Radio Emission	12 Mar 1121
13 Mar 0025	10-245 MHz Bursts	12 Mar
14 Mar 0009	1-245 MHz Burst	13 Mar
14 Mar 1500	K= 4 Observed	14 Mar 12 - 15
14 Mar 1500	K= 4 Warning valid	14 Mar 1500 - 15 Mar 1500





*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
17 Mar	150	15	4	31 Mar	135	15	4
18	145	15	4	01 Apr	130	15	4
19	140	10	3	02	125	12	3
20	130	7	2	03	125	12	3
21	125	7	2	04	130	10	3
22	125	7	2	05	130	12	3
23	125	10	3	06	135	12	3
24	125	7	2	07	135	12	3
25	125	5	2	08	140	10	3
26	125	5	2	09	145	8	3
27	125	10	3	10	150	10	3
28	125	20	4	11	150	15	4
29	130	15	4	12	150	12	3
30	135	15	4				



### *Energetic Events*

Date	Time (UT)			X-ray		Optical Information			Peak		Sweep Freq	
	Begin	Max	½	Class	Flux	Imp Brtns	Location		Radio Flux		Intensity	
			Max				Lat	CMD	245	2695	II	IV
08 Mar 99	0630	0637	0643	M2.6	.010	SF	S24E93		64		3	
13 Mar 99	2022	2034	2039	M1.9	.012	SF	N17E39		55			
14 Mar 99	0119	0127	0140	M2.1	.018	1N	N15E39		29			
14 Mar 99	0908	1010	1025	M1.1	.032	SF	N16E34		65			

### *Flare List*

Date	Time			X-ray Class.	Optical Imp / Brtns	Location Lat CMD	Rgn #
	Begin	Max	End				
08 March	0008	0031	0036	C7.9			
	0352	0355	0358	B5.8			
	0553	0559	0602	B6.2			
09 March	0635	0635	0650	M2.6	SF	S24E93	8484
	1540	1542	1546		SF	N22E71	8485
	0002	0005	0016		SF	S19W30	8483
	0043	0046	0048	B7.1			
	0347	0353	0359	C1.6			
	0410	0413	0415	B8.3			
	0533	0537	0540	B8.9			
	1054	1059	1106	B7.0			
	1744	1826	1841	C2.0	1F	S26E71	8484
	1815	1818	1825		SF	N20E57	8485
	1843	1847	1855		SF	S24E69	8484
	2007	2010	2030	C1.1	SF	S24E68	8484
	2140	2147	2159		SF	S24E68	8484
	2247	2254	2322	C3.2	1F	S24E66	8484
10 March	2323	2327	2335	B8.5			
	0225	U0226	A0310	B8.7	SF	N23E55	8485
	0317	0324	0327	C1.6			
	0504	0506	0511	B7.9	SF	N20E50	8485
	0938	0943	0950	C1.0			
	1345	1348	1350	B5.1			
	1421	1422	1426		SF	N22E49	8485
	1544	1546	1555	B9.1	SF	N22E45	8485
	1612	1613	1630	B8.6	SF	S29W43	8477
	1828	1833	1835	C1.1			
	1917	1917	1933		SF	S30W45	8477
	2027	2029	A2040	B9.5	SF	N23E45	8485
	2031	2031	2036		SF	S25E55	8484
2211	2215	2221	B8.6				
2246	2247	2253	C1.4	SF	S17W64	8483	
2351	2354	2358	B5.2	SF	S17W63	8483	



*Flare List-continued*

Date	Time			X-ray Class.	Imp / Brtns	Optical	Rgn #
	Begin	Max	End			Location Lat CMD	
11 March	0005	0009	0016	C8.7	SF	S17W63	8483
	0019	0021	0035		SF	S18W64	8483
	0155	0158	0200	B5.8			
	0634	0644	0649	C1.7	SF	N16E76	8487
	0746	0748	0751		SF	N16E74	8487
	0819	0824	0833	C5.0	SF	N16E74	8487
	0824	0825	0829		SF	S20W70	8483
	0911	0922	0925	B7.2			
	0926	0936	A0948		SF	N17E71	8487
	1002	1006	1009	C2.0			
	B1123	U1125	A1135		SF	N20E33	8485
	1142	1147	1151	B9.3			
	1158	1159	1204	C2.0	SF	N15E71	8487
	1207	1207	1214		SF	N20E33	8485
	1312	1324	1335		SF	N14E71	8487
	1414	1414	1430		SF	N14E71	8487
	1503	1503	1508		SF	N14E70	8487
	1532	1533	1538		SF	S20W68	8483
	1544	1545	1548		SF	N14E70	8487
	1620	1620	1626		SF	S30W57	8477
	1658	1659	1710		SF	S20W71	8483
	1716	1717	1722	C2.8	SN	S18W70	8483
	1915	1918	1924	B8.8	SF	N17E68	8487
	B1959	2001	2003		SF	S19W77	8483
	2032	2033	2037	C6.1	SF	N16E64	8487
	2041	2046	2048	C1.4			
	2255	2257	2303		SF	N17E63	8487
2333	2336	2346		SF	N16E63	8487	
12 March	0005	0007	0013	C1.3	SF	N20E24	8485
	0009	0010	0016		SF	N15E66	8487
	0053	0056	0058	B8.4			
	0643	0650	0654	C2.3	SF	N15E59	8487
	0740	0754	0801	C1.8	SF	N15E58	8487
	0755	0758	0801	C2.6			
	0853	0856	0903	C1.0	SN	N15E57	8487
	0930	0931	0935		SF	N15E55	8487
	1235	1237	1241		SF	N14E57	8487
	1322	1325	1328		SF	N14E55	8487
	1328	1329	1332	B7.7	SF	N19E16	8485
	1333	1335	1336		SF	N14E57	8487
	1423	1443	1446		SF	N14E56	8487



*Flare List-continued*

Date	Time			X-ray Class.	Optical		Rgn #
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
12 March	1457	1503	1505	B8.1	SF	N14E55	8487
	1539	1539	1542		SF	N14E56	8487
	1543	1543	1546		SF	N14E55	8487
	1550	1553	1615	C1.0	SF	N21E19	8485
	1634	1636	1639	C1.1	SF	N19E15	8485
	1719	1727	1743	C9.4	1B	N14E55	8487
	1752	1752	1759		SF	N19E14	8485
	1822	1827	1831	C1.0	SF	N19E13	8485
	1839	1841	1844		SF	N16E53	8487
	1939	1940	1949		SF	N17E52	8487
	2037	2037	2047	C3.2	1B	N13E52	8487
	2157	2159	2208	B8.6	SF	N14E53	8487
	2338	2340	0002	C1.3	SF	N17E51	8487
	13 March	0151	0155	0204	C1.0		
0338		0339	0343	C1.1	SF	N15E49	8487
0428		0430	0439		SF	N17E48	8487
0501		0502	0505	C1.1	SF	N15E47	8487
0510		0525	0535	C2.7	SF	N17E50	8487
0536		0545	0551		SF	N17E48	8487
0551		0557	0613		SF	N17E48	8487
0904		0909	0913	C1.1			
1048		1054	1100	C4.3			
B1120		U1121	A1137	C2.7	SF	N15E47	8487
1420		1424	1429		SF	N17E43	8487
1430		1435	1439		SF	N17E43	8487
1519		1522	1527		SF	N17E42	8487
1537		1541	1551		SF	N17E42	8487
1634		1637	1643		SF	N22E02	8485
1655		1712	1722		SF	N22E02	8485
1731		1734	1739		SF	N16E42	8487
1853		1854	1913		SF	N24E01	8485
1951		1951	1958		SF	N15E39	8487
1959		2002	2007		SF	N17E40	8487
2018		2018	2023	M1.9	SF	N17E39	8487
14 March		0113	0113	0118		SF	N21W01
	0122	0125	0156	M2.1	1N	N15E39	8487
	0156	0158	0201		SF	N23W01	8485
	0216	0216	0226		SF	N21E00	8485
	0248	0250	0302		SF	N24W03	8485
	0407	0412	0426	C1.5	SF	N21W03	8485
	0608	0610	0623	C1.9	SF	N25W05	8485
	0910	0916	A1023	M1.1	SF	N16E34	8487
	1258	1301	1310		SF	N22W08	8485









**Region Summary-continued**

Date	Location		Sunspot Characteristics				Flares										
	( ° Lat ° CMD)	Helio Lon	Area (10 <sup>-6</sup> hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical						
								C	M	X	S	1	2	3	4		
	<i>Region</i>		<i>8480</i>														
02 Mar	N25E66	355	0000	00	AXX	001	A										
03 Mar	N25E51	357	0010	04	BXO	002	B										
04 Mar	N25E39	356	0000	01	AXX	002	A										
05 Mar	N26E26	356	0010	06	BXO	003	B										
06 Mar	N25E10	358	0010	01	AXX	001	A										
07 Mar	N26E00	355	0000	00	AXX	001	A										
08 Mar	N26W13	355															
09 Mar	N26W26	355															
10 Mar	N26W39	355															
11 Mar	N26W52	355															
12 Mar	N26W65	355															
13 Mar	N26W78	355															

0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 355

*Region 8481*

03 Mar	S18W15	063	0010	02	BXO	002	B										
04 Mar	S18W28	063	0010	02	BXO	002	B										
05 Mar	S18W41	063															
06 Mar	S18W54	063															
07 Mar	S18W67	063															
08 Mar	S18W80	063															

0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 063

*Region 8482*

06 Mar	S26E64	304	0000	00	AXX	001	A										
07 Mar	S27E54	301	0010	05	BXO	004	B										
08 Mar	S31E49	293	0010	03	BXO	002	B										
09 Mar	S34E36	293															
10 Mar	S34E23	293															
11 Mar	S34E10	293															
12 Mar	S34W03	293															
13 Mar	S34W16	293															
14 Mar	S34W29	293															

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 293







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

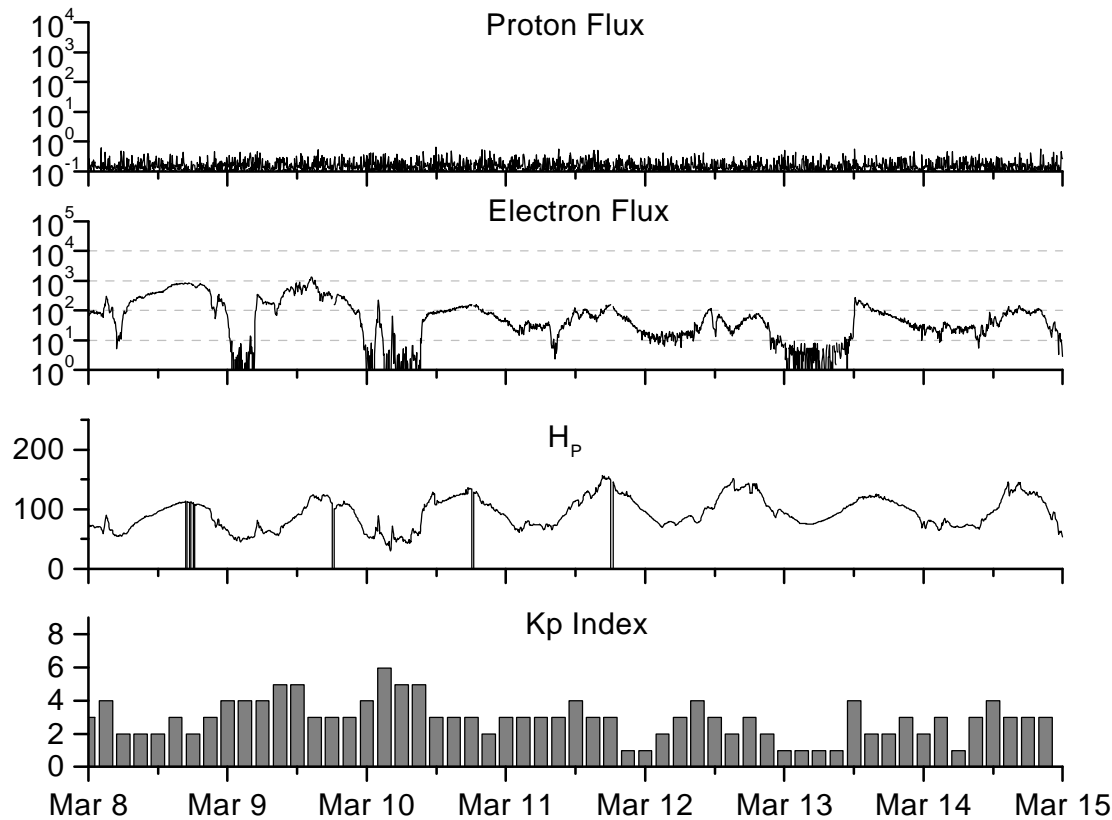
Month	Sunspot Numbers			Radio Flux		Geomagnetic			
	<u>Observed values</u> SWO	RI	Ratio RI/SWO	<u>Smooth values</u> SWO	RI	**Penticton 10.7 cm	Smooth Value	<u>Planetary</u> Ap	Smooth Value
<b>1997</b>									
March	14.4	08.7	0.60	20.4	13.5	73.5	75.1	08	08.9
April	24.5	15.5	0.63	24.0	16.5	74.5	76.8	10	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	08.6
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
<b>1998</b>									
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	11.2*
April	73.6	53.4	0.73	77.7	56.5*	108.3	109.1*	10	11.4*
May	74.3	56.3	0.76	81.4	59.3*	106.7	112.4*	18	11.7*
June	93.6	70.7*	0.76*	85.9	62.4*	108.4*	116.2*	10	12.0*
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*	
September	119.0	92.9*	0.78*			138.4*		14*	
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*	
<b>1999</b>									
January	94.3	62.4*	0.66*			140.6*		08*	
February	93.4	66.1	0.70*			142.0*		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 08 March 1999*

*Protons* plot contains the five-minute averaged integral proton flux (protons/ cm<sup>2</sup>-sec-sr) as measured by GOES-8 (W75) for each of three energy thresholds: greater than 10, 50, and 100 MeV.

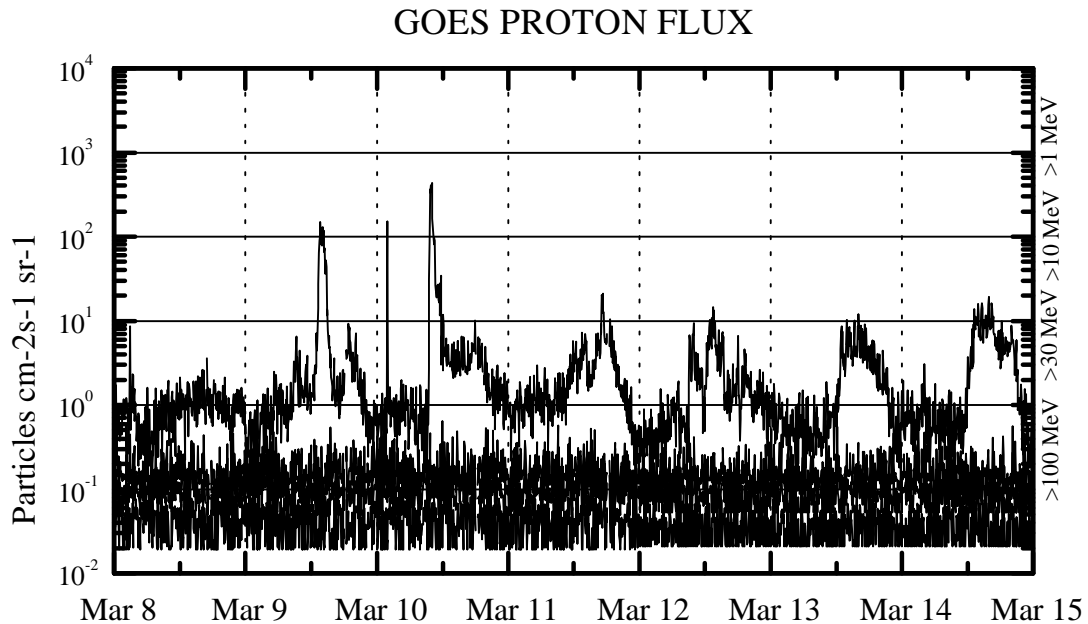
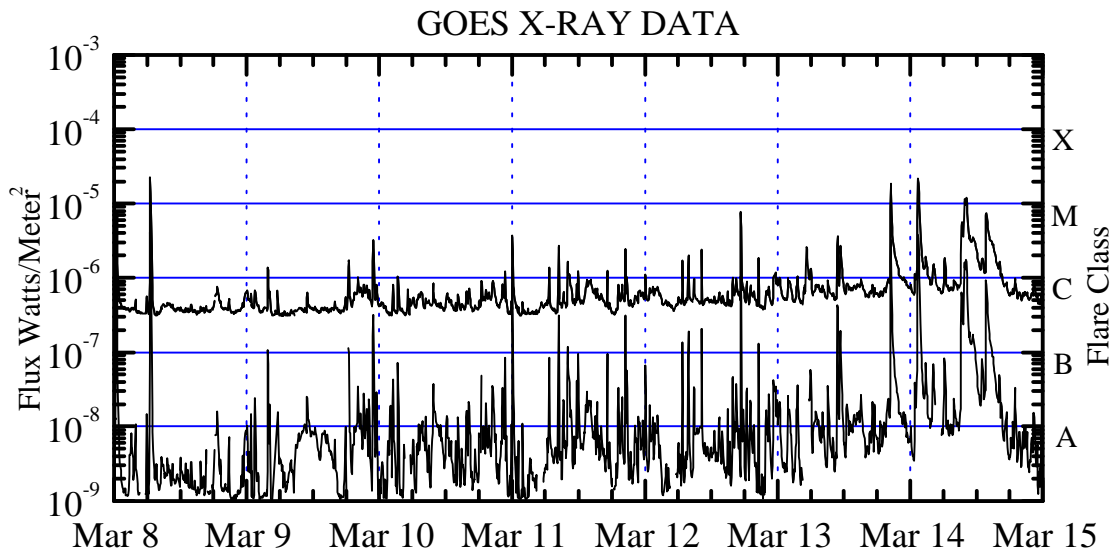
*Electrons* plot contains the five-minute averaged integral electron flux (electrons/ cm<sup>2</sup>-sec-sr) with energies greater than 2 MeV at GOES-8.

*H<sub>p</sub>* 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<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>p</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*

X-ray plot contains five minute averaged x-ray flux ( $\text{watts/m}^2$ ) 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 ( $\text{protons/cm}^2\text{-sec-sr}$ ) as measured by GOES-8 (W75) for each of the energy thresholds:  $>1$ ,  $>10$ ,  $>30$  and  $>100$  MeV. P10 event threshold is 10 pfu ( $\text{protons/cm}^2\text{-sec-sr}$ ) at greater than 10 MeV.

