

**Space Weather Highlights  
16-22 February 1998**

Solar activity was very low to low. Region 8156 (S25, L = 033, class/area Eki/520 on 16 February) produced isolated C-class subflares on 17 - 18 February during a period of gradual growth.

Solar wind data were received from the WIND spacecraft a few hours per day (no data were received during 20 - 22 February). Velocities ranged 330 - 490 km/sec during most of the period, but increased 400 - 500 km/sec during 18 - 19 February. Densities generally ranged 03 - 10 p/cc, but increased during 17 - 18 February, peaking at 34 p/cc. Bz hovered about zero in the plus to minus 05 nT (GSM) range most of the period, but shifted south during 17 - 18 February with a maximum deflection of minus 17 nT detected around 18/0000UT. Solar sector orientation was mostly toward (phi angle near 315 degrees), but shifted to away conditions (phi angle near 135 degrees) during 17 February.

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 during 16 - 17 and 21 February.

The geomagnetic field was at quiet levels through midday, 17 February. A disturbance began during the latter half of 17 February and continued through 18 February. Active to major storm conditions were detected at all latitudes during the disturbance. Activity returned to quiet to unsettled levels for the balance of the period.

**Space Weather Forecast  
25 February 1998 -23 March 1998**

Solar activity is expected to be very low to low. Isolated C-class flare activity is expected.

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 high levels through 02 March. The flux is expected to be at normal to moderate levels for the remainder of the period.

The geomagnetic field is expected to be at mostly quiet to unsettled levels. However, active conditions are possible during 25 - 28 February.



### *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.)	(10 <sup>6</sup> hemi.)		C	M	X	S	Optical 1	Optical 2	Optical 3	Optical 4
16 February	107	88	580	B2.0	1	0	0	0	0	0	0	0
17 February	105	85	540	B2.5	2	0	0	2	0	0	0	0
18 February	103	64	420	B1.4	3	0	0	7	1	0	0	0
19 February	99	57	420	B1.6	1	0	0	7	0	0	0	0
20 February	96	29	360	B1.1	1	0	0	6	0	0	0	0
21 February	95	28	360	A8.6	0	0	0	0	0	0	0	0
22 February	96	38	230	A8.6	1	0	0	1	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
16 February	3.0E+5	1.8E+4	4.2E+3		7.4E+7	
17 February	4.2E+5	1.7E+4	3.9E+3		2.7E+7	
18 February	6.4E+5	1.7E+4	3.7E+3		3.3E+6	
19 February	1.5E+5	1.7E+4	3.8E+3		6.2E+6	
20 February	2.6E+5	1.7E+4	3.9E+3		1.9E+7	
21 February	4.1E+5	1.8E+4	4.5E+3		4.1E+7	
22 February	5.2E+5	1.7E+4	4.2E+3		4.3E+7	

### *Daily Geomagnetic Data*

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
16 February	1	0-0-0-0-0-1-1-1	1	0-0-0-1-0-1-1-0	3	0-0-1-0-1-1-1-1
17 February	12	0-1-1-1-3-3-2-5	22	0-0-0-1-5-5-5-4	14	1-0-1-1-4-3-3-5
18 February	15	4-3-3-3-2-3-3-3	*	4-5-5-5-5-5-5-*	26	5-4-4-4-3-4-3-3
19 February	5	1-1-1-2-1-1-2-3	6	1-0-0-3-2-3-2-2	7	3-1-1-2-1-2-3-2
20 February	8	4-1-1-1-1-1-2-3	7	4-1-2-2-0-1-1-0	7	4-1-2-2-1-1-2-2
21 February	2	2-0-0-0-1-1-1-1	2	1-0-0-0-0-2-1-1	4	2-0-0-1-1-2-2-1
22 February	4	1-1-1-2-1-2-2-0	10	1-1-1-5-2-3-1-0	6	1-2-1-3-2-2-2-0



*Alerts and Warnings Issued*

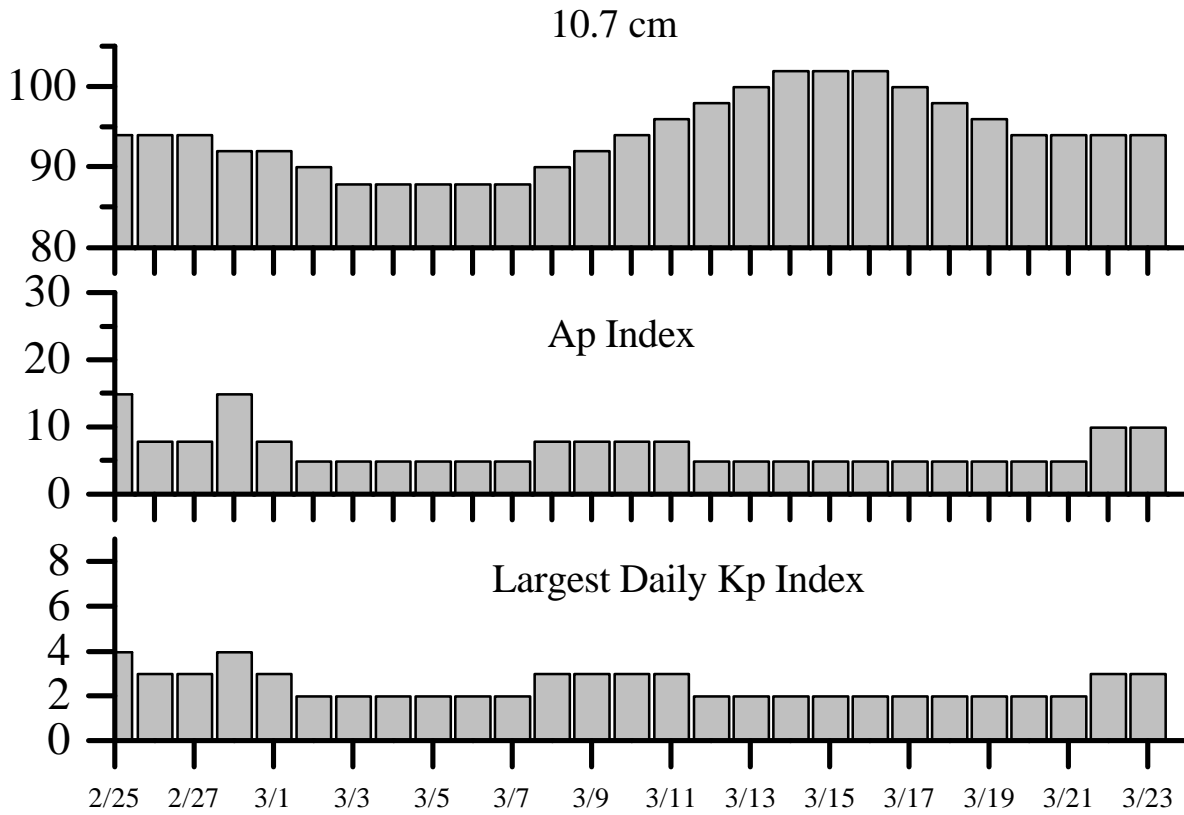
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Date and Time of Issue (UT)	Type of Alert or Warning	Date and Time of Event (UT)
16 Feb 000	>2MeV Electron Event in Progress $\geq 1000$ pfu	15 Feb
17 Feb 006	>2MeV Electron Event in Progress $\geq 1000$ pfu	16 Feb
18 Feb 002	>2MeV Electron Event in Progress $\geq 1000$ pfu	17 Feb
18 Feb 300	K= 6 observed	18 Feb 00-03
18 Feb 600	A $\geq 20$ observed	18 Feb 0600
18 Feb 1805	K= 4 observed	18 Feb 15-18
20 Feb 0300	K= 4 observed	20 Feb 00-03
21 Feb 1309	Stratwarm Alert Exists Saturday	
21 Feb 1926	>2MeV Electron Event $\geq 1000$ pfu	21 Feb 1812
22 Feb 1323	Stratwarm Alert Exists Sunday	

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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
25 Feb	94	15	4	11	96	8	3
26	94	8	3	12	98	5	2
27	94	8	3	13	100	5	2
28	92	15	4	14	102	5	2
01 Mar	92	8	3	15	102	5	2
02	90	5	2	16	102	5	2
03	88	5	2	17	100	5	2
04	88	5	2	18	98	5	2
05	88	5	2	19	96	5	2
06	88	5	2	20	94	5	2
07	88	5	2	21	94	5	2
08	90	8	3	22	94	10	3
09	92	8	3	23	94	10	3
10	94	8	3				



***Energetic Events***

Date	Time (UT)		X-ray		Optical Information			Peak		Sweep Freq		
	Begin	Max	½ Max	Class	Integ Flux	Imp Brtns	Location		Radio Flux		Intensity	
							Lat	CMD	245	2695	II	IV

**No Events Observed**

***Flare List***

Date	Time			X-ray Class.	Optical		Rgn #
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
16 February	0208	0215	0218	B5.7			
	0302	0326	0342	C3.2			
	1704	1709	1715	B1.9			
	2136	2140	2145	B2.4			
17 February	0210	0217	0222	B5.7			
	0346	0351	0400	C1.0			
	0426	0430	0432	B4.0			
	0923	0953	1016	C2.9	SF	S27W16	8156
	B1053	1109	1153		SF	S26W16	8156
	1933	1936	1940	B2.1			
	2350	2354	2357	B2.3			
18 February	0634	0638	0649	B3.7	SF	S24W06	8158
	0921	0924	0945	C1.5	SF	S23W24	8156
	1123	1124	1130		SF	S22W25	8156
	1135	1138	1244	C5.2	1F	S24W30	8156
	1221	1226	1230	C1.8			
	1508	1508	1519	B2.5	SF	S23W26	8156
	1526	1527	1534	B4.0	SF	S23W26	8156
	1542	1652	1707		SF	S23W27	8156
19 February	1642	1652	1707	B6.8	SF	S23W27	8156
	0214	0221	0227	B3.8			
	0504	0509	0513	B2.2			
	0523	0527	0552	C1.1	SF	S27W40	8156
	0630	0630	0632	B4.1	SF	S27W40	8156
	0716	0717	0723		SF	S27W41	8156
	1239	1239	1243		SF	S27W44	8156
	1454	1454	1512	B8.0	SF	S27W45	8156
	1656	1657	1713	B7.7	SF	S21W43	8156
	2320	2321	2323	B1.8	SF	S21W44	8156



*Flare List – continued.*

Date	Time			X-ray Class.	Optical		Rgn #
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
20 February	0055	0101	0104	B3.7			
	0123	0124	0130	B3.6	SF	S27W51	8156
	0303	0323	0329	B2.8	SF	S25W48	8156
	1007	1007	1041	C1.0	SF	S27W55	8156
	1205	1211	1219		SF	S25W55	8156
	1234	1246	1303	B2.6	SF	S22W51	8156
	1736	1739	1758	B4.9	SF	S22W57	8156
	2005	2009	2015	B1.4			
21 February	0339	0347	0355	B6.6			
	0500	0508	0512	B2.7			
22 February	0107	0112	0116	B2.5			
	0511	0531	0535	B2.3			
	0748	0753	0757	B6.6			
	1342	1345	1347	B1.6			
	1416	1421	1424	B2.0			
	1529	1533	1538	B2.7			
	1605	1607	1618	B3.0	SF	S33E37	8162
	1636	1646	1651	C1.4			
	1800	1806	1813	B3.1			
	2247	2251	2254	B2.6			
2320	2323	2326	B2.7				



## 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 8151</i>																					
03 Feb	S24E75	120	0030	02	CSO	002	B														
04 Feb	S24E61	121	0060	03	CSO	002	B														
05 Feb	S22E49	120	0060	02	HSX	004	A														
06 Feb	S23E38	118	0060	02	HSX	002	A														
07 Feb	S21E24	119	0030	02	HSX	001	A														
08 Feb	S22E11	119	0040	02	HSX	001	A														
09 Feb	S22W02	118	0040	01	HRX	001	A														
10 Feb	S24W14	117	0050	02	HSX	001	A														
11 Feb	S24W26	116	0020	01	HSX	001	A														
12 Feb	S24W40	117	0000	01	AXX	001	A														
13 Feb	S24W52	116	0000	00	AXX	001	A														
14 Feb	S24W67	117	0000	00	AXX	001	A														
15 Feb	S22W80	117	0000	00	AXX	001	A														

0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 118

<i>Region 8153</i>																				
08 Feb	S40E38	092	0010	03	BXO	002	B													
09 Feb	S39E27	089	0020	04	BXO	002	B													
10 Feb	S39E16	087	0020	07	BXO	003	B													
11 Feb	S39E02	088	0000	00	AXX	001	A													
12 Feb	S39W13	090	0000	00	AXX	001	A													
13 Feb	S39W26	090																		
14 Feb	S39W39	090																		
15 Feb	S39W52	090																		
16 Feb	S39W65	090																		
17 Feb	S39W78	090																		
18 Feb	S39W91	090																		

0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 088



**Region Summary- continued.**

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

*Region 8154*

09 Feb	S24E29	087	0000	00	AXX	001	A										
10 Feb	S24E15	088	0000	00	AXX	001	A										
11 Feb	S23E02	088															
12 Feb	S23W11	088															
13 Feb	S23W24	088															
14 Feb	S23W37	088															
15 Feb	S23W50	088															
								0	0	0	0	0	0	0	0	0	0

Died on Disk.

Absolute heliographic longitude: 088

*Region 8155*

10 Feb	S14E05	098	0020	03	BXO	004	B										
11 Feb	S14W09	099															
12 Feb	S14W22	099															
13 Feb	S14W35	099															
								0	0	0	0	0	0	0	0	0	0

Died on Disk.

Absolute heliographic longitude: 098

*Region 8156*

10 Feb	S24E71	032	0020	04	BXO	003	B										
11 Feb	S24E57	033	0040	07	CSO	006	B					3					
12 Feb	S25E43	034	0210	09	DSO	011	B					5					
13 Feb	S25E30	034	0300	11	EAI	016	B					1					
14 Feb	S24E16	034	0360	11	EKI	029	B					3					
15 Feb	S25E04	033	0380	11	ESI	026	B	3				8					
16 Feb	S25W09	033	0520	12	EKI	024	B										
17 Feb	S25W21	032	0480	12	EKI	024	B	1				2					
18 Feb	S25W34	032	0370	13	EHI	016	BG	2				6	1				
19 Feb	S25W47	031	0380	12	EHI	010	B	1				7					
20 Feb	S25W60	031	0360	12	EKO	008	BG	1				6					
21 Feb	S25W72	030	0350	10	DKO	005	B										
22 Feb	S25W89	034	0200	06	HSX	002	A										
								8	0	0	41	1	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 033





**Region Summary- continued.**

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 8157</i>																
11 Feb	N27E66	024	0010	03	BXO	003	B									
12 Feb	N27E54	023	0000	00	AXX	001	A									
13 Feb	N26E41	023	0000	00	AXX	001	A									
14 Feb	N28E28	022	0000	00	AXX	001	A									
15 Feb	N28E15	022														
16 Feb	N28E02	022														
17 Feb	N22E11	000	0020	06	CRO	003	B									
18 Feb	N22W02	000														
19 Feb	N28W37	022														
20 Feb	N28W50	022														
21 Feb	N28W63	022														
22 Feb	N28W76	022														

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 022

<i>Region 8158</i>																
11 Feb	S19E77	013	0010	03	BXO	002	B									
12 Feb	S19E62	015	0010	03	BXO	003	B									
13 Feb	S19E50	014	0010	04	BXO	004	B									
14 Feb	S20E36	014	0020	04	CSO	004	B									
15 Feb	S21E23	014	0010	05	BXO	004	B									
16 Feb	S21E10	014	0020	05	CRO	005	B									
17 Feb	S21W03	014	0010	06	BXO	003	B									
18 Feb	S22W14	012	0010	03	BXO	003	B						1			
19 Feb	S21W29	013	0020	05	BXO	004	B									
20 Feb	S21W42	013														
21 Feb	S21W55	013														
22 Feb	S20W69	014	0010	04	BXO	002	B									

0 0 0 1 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 014



**Region Summary- continued.**

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 8159</i>																	
14 Feb	N33E41	009	0010	03	BXO	003	B										
15 Feb	N30E29	008	0010	06	BXO	003	B										
16 Feb	N32E13	011	0010	03	BXO	002	B										
17 Feb	N32E00	011															
18 Feb	N32W13	011															
19 Feb	N32W26	011															
20 Feb	N32W39	011															
21 Feb	N32W52	011															
22 Feb	N32W65	011															

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 011

*Region 8160*

15 Feb	N23E36	001	0010	03	BXO	002	B										
16 Feb	N23E23	001	0020	05	CRO	005	B										
17 Feb	N22E11	000	0020	06	CRO	004	B										
18 Feb	N23W02	360	0010	06	BXO	003	B										
19 Feb	N23W13	357	0010	04	BXO	002	B										
20 Feb	N23W26	357															
21 Feb	N23W39	357															
22 Feb	N23W52	357															

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 360

*Region 8161*

16 Feb	N25E54	330	0010	03	BXO	002	B										
17 Feb	N25E40	331	0010	00	AXX	001	A										
18 Feb	N26E27	331	0010	03	BXO	003	B										
19 Feb	N16E19	325	0010	00	AXX	001	A										
20 Feb	N25E04	327	0000	00	AXX	001	A										
21 Feb	N25W09	327	0000	00		000											
22 Feb	N25W22	327	0000	00		000											

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 327

*Region 8162*

21 Feb	S32E46	272	0010	03	BXO	003	B										
22 Feb	S32E33	272	0000	00		000											

1  
0 0 0 1 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 272



***Region Summary- continued.***

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	
22 Feb	S22W28	333	0020	03	BXO	004	B	0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 333



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

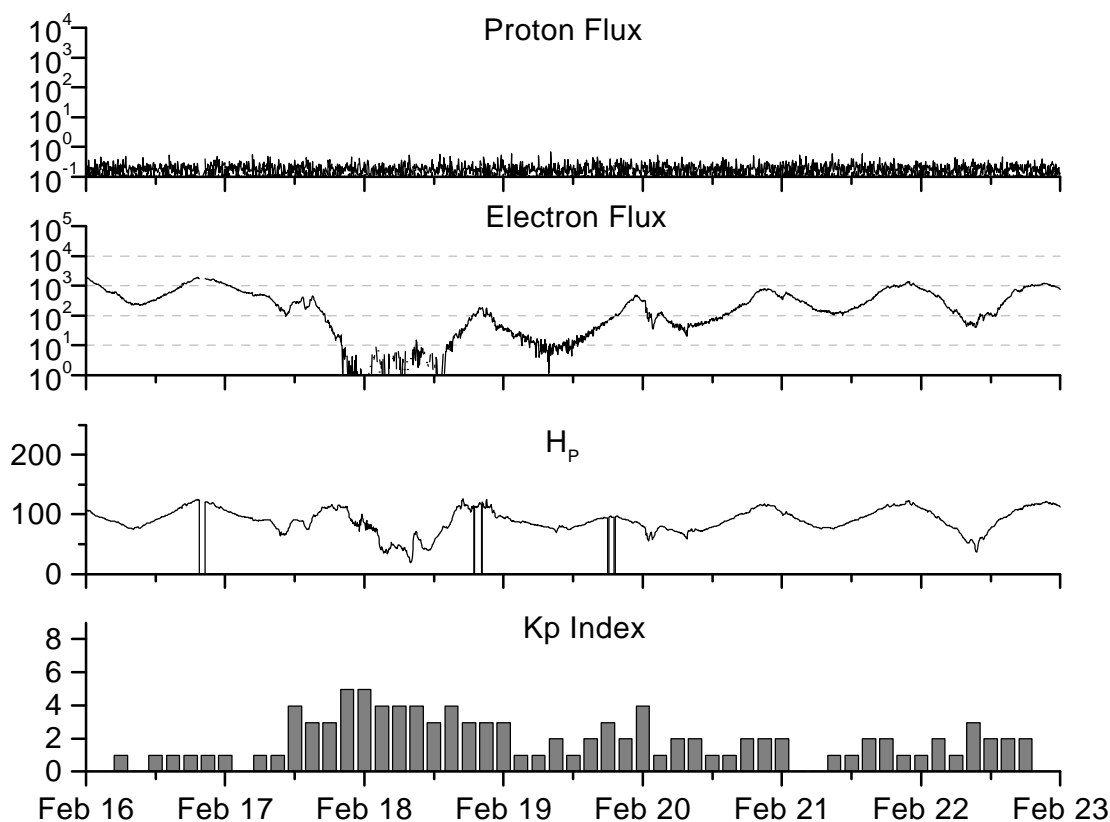
Month	Sunspot Numbers					Radio Flux		Geomagnetic	
	Observed values SWO	RI	Ratio RI/SWO	Smooth values SWO	RI	**Penticton 10.7 cm	Smooth Value	Planetary Ap	Smooth Value
<b>1996</b>									
February	09.1	04.4	0.48	16.2	10.1	71.5	72.2	10	09.8
March	12.1	09.2	0.76	15.4	09.7	72.7	72.1	11	09.9
April	08.5	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
<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	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*			79.0		08*	
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*	
<b>1998</b>									
January	51.8	32.3*	0.62*			93.5*		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 16 February 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.

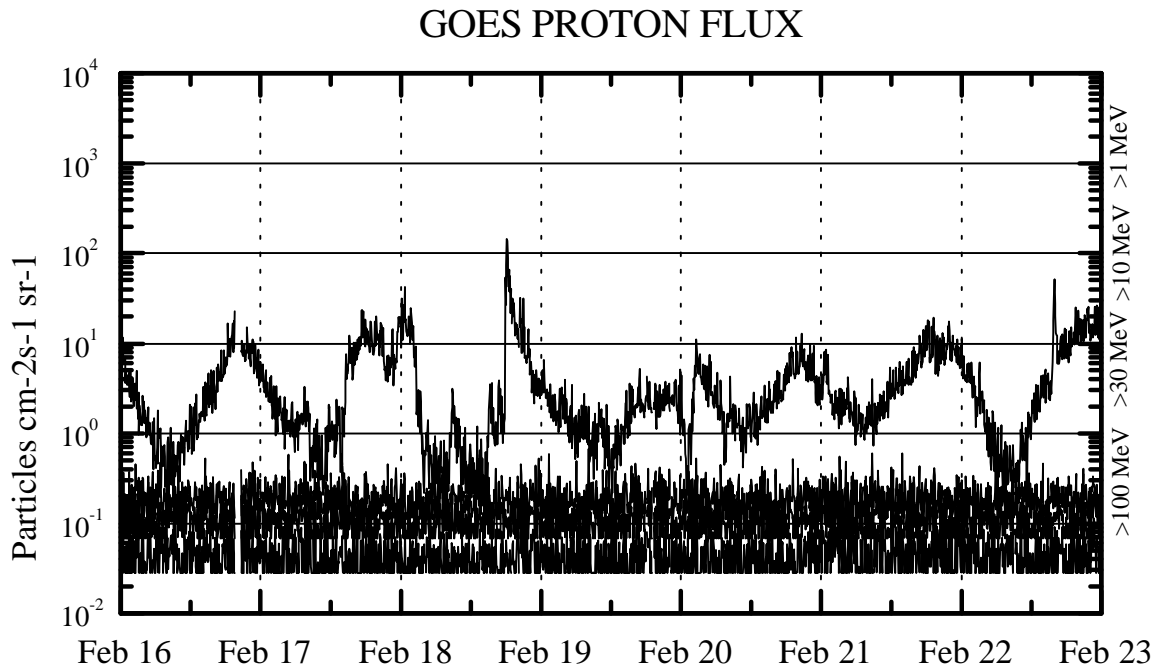
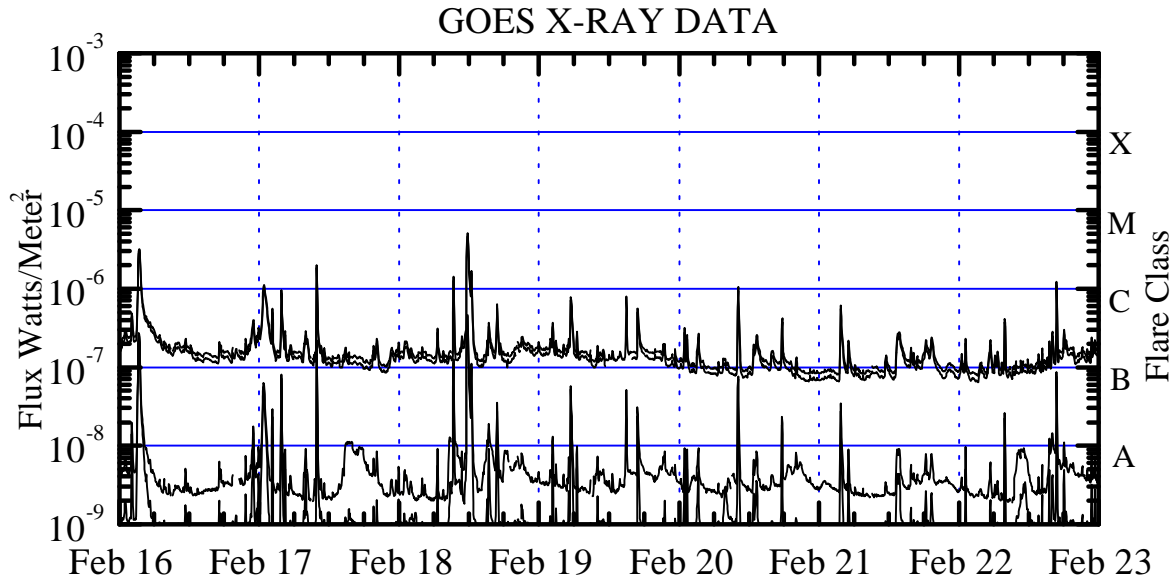
*Electrons* plot contains the five-minute averaged integral electron flux (electrons/ cm<sup>2</sup>-sec-sr) with energies greater than 2 MeV at GOES-9.

*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>p</sub>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/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.

