

Space Weather Highlights 23 - 29 February 2004

**SWO PRF 1487
02 March 2004**

Solar activity ranged from very low to high levels with all of the significant activity occurring on 26 February. Region 564 (N14, L=160, class/area, Ekc/650 on 26 February) was responsible for all of the major flare activity during the summary period with an X1.1/2n at 26/0203 UTC and an M5.7/1n at 26/2230 UTC. Both events were very impulsive; LASCO imagery did not show CME activity associated with either flare. Since forming on the disk on 21 February, Region 564 exhibited rapid growth, forming a complex magnetic structure (beta-gamma-delta) that contributed to the increase in activity on the 26th. Since the activity on 26 February, Region 564 exhibited slow decay as it approached the west limb. The only other regions of interest this period were Region 565 (S05, L=140, class/area, Dai/130 on 26 February) that formed on the disk on 23 February and Region 567 (S13, L=070, class/area, Dao/120 on 29 February) that formed on the disk on 27 February. Region 567 produced two weak C-class flares on 28 February.

Solar wind data were available from the NASA Advanced Composition Explorer (ACE) spacecraft during most of the summary period. The period began with solar wind speeds slightly elevated between 400 – 450 km/s and declined to about 325 km/s by 26 February. A solar sector boundary crossing was observed on ACE mid-day on the 26th as phi switched from a towards orientation to an away orientation. Early on 27 February, the wind speed began a steady increase reaching 800 km/s by mid-day on 29 February. The increased solar wind speeds were driven by a small, favorably positioned, recurrent coronal hole. The Bz component of the interplanetary magnetic field did not vary beyond +/- 5 nT from 23 to 27 February. Increased variability of +/- 15 nT was evident after 27 February due to the influence of the high-speed stream.

There were no greater than 10 MeV proton events at geosynchronous orbit during the summary period.

The greater than 2 MeV electron flux at geosynchronous orbit remained below threshold levels every day of the summary period but the 24th where high levels were recorded.

The geomagnetic field ranged from quiet to minor storm levels during the period. Mostly quiet to unsettled levels were observed on 23 - 27 February with one isolated active period recorded late on the 27th. Quiet to minor storm levels occurred on 28 and 29 February. The increase on 27 - 29 February was due to a coronal hole driven high-speed stream.

Space Weather Outlook 03 March - 29 March 2004

Solar activity is expected to be low with a chance for moderate levels until 03 March when Region 564 is due to rotate off the west limb. Predominantly very low to low activity levels are expected from 03 March through the middle of March. By 15 March, low to moderate level activity may return due to the return of Region 564.

No greater than 10 MeV proton events are expected during the period.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to reach high levels on 03 -04 March and again on 10 - 16 March due to recurrent coronal holes.

Geomagnetic activity is expected to range from quiet to minor storm levels. A large, recurrent coronal hole high-speed stream is due to return on 09 - 14 March and is expected to produce active to minor storm conditions. A second, weak coronal hole high-speed stream is due to return on 19 – 20 March and is expected to produce quiet to solar wind stream.



Daily Solar Data

Date	Radio Flux 10.7 cm	Sun spot No.	Sunspot Area (10 ⁻⁶ hemi.)	X-ray Background	Flares								
					X-ray Flux			Optical					
					C	M	X	S	1	2	3	4	
23 February	104	68	360	B1.4	0	0	0	0	0	0	0	0	0
24 February	106	85	640	B1.2	0	0	0	2	0	0	0	0	0
25 February	119	107	770	B3.0	8	0	0	9	0	0	0	0	0
26 February	121	105	790	B2.5	5	1	1	3	1	1	0	0	0
27 February	122	90	1110	B2.0	1	0	0	0	0	0	0	0	0
28 February	116	104	1070	B2.0	3	0	0	0	0	0	0	0	0
29 February	110	81	880	B1.6	0	0	0	0	0	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
	23 February	3.6E+5	1.3E+4	3.3E+3		1.9E+7
24 February	4.6E+5	1.4E+4	3.0E+3		3.4E+7	
25 February	3.1E+5	1.2E+4	2.7E+3		5.5E+6	
26 February	3.7E+5	1.3E+4	2.8E+3		1.1E+7	
27 February	5.5E+5	1.3E+4	2.7E+3		7.7E+6	
28 February	5.4E+5	1.2E+4	2.6E+3		3.6E+6	
29 February	1.9E+6	1.2E+4	2.6E+3		2.0E+7	

Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	23 February	9	3-2-2-2-3-2-2-2	7	2-1-2-3-2-2-2-1	8
24 February	9	4-2-3-2-1-1-1-1	16	2-2-4-4-4-3-3-1	11	3-3-3-3-3-3-2-2
25 February	3	1-1-1-1-2-0-1-1	11	2-1-3-5-3-0-1-0	8	2-1-2-3-3-3-2-2
26 February	2	1-1-0-0-2-0-0-0	2	0-0-1-1-2-1-0-0	5	1-1-1-2-2-3-2-1
27 February	8	1-3-1-2-2-1-3-2	6	0-2-1-3-1-0-3-2	11	2-3-1-3-2-3-4-3
28 February	14	1-3-4-2-3-3-3-3	42	2-3-6-6-5-6-2-3	20	2-3-5-4-3-4-3-3
29 February	17	2-2-2-5-4-2-3-3	39	1-2-2-7-6-5-3-3	21	2-3-3-5-5-4-3-3

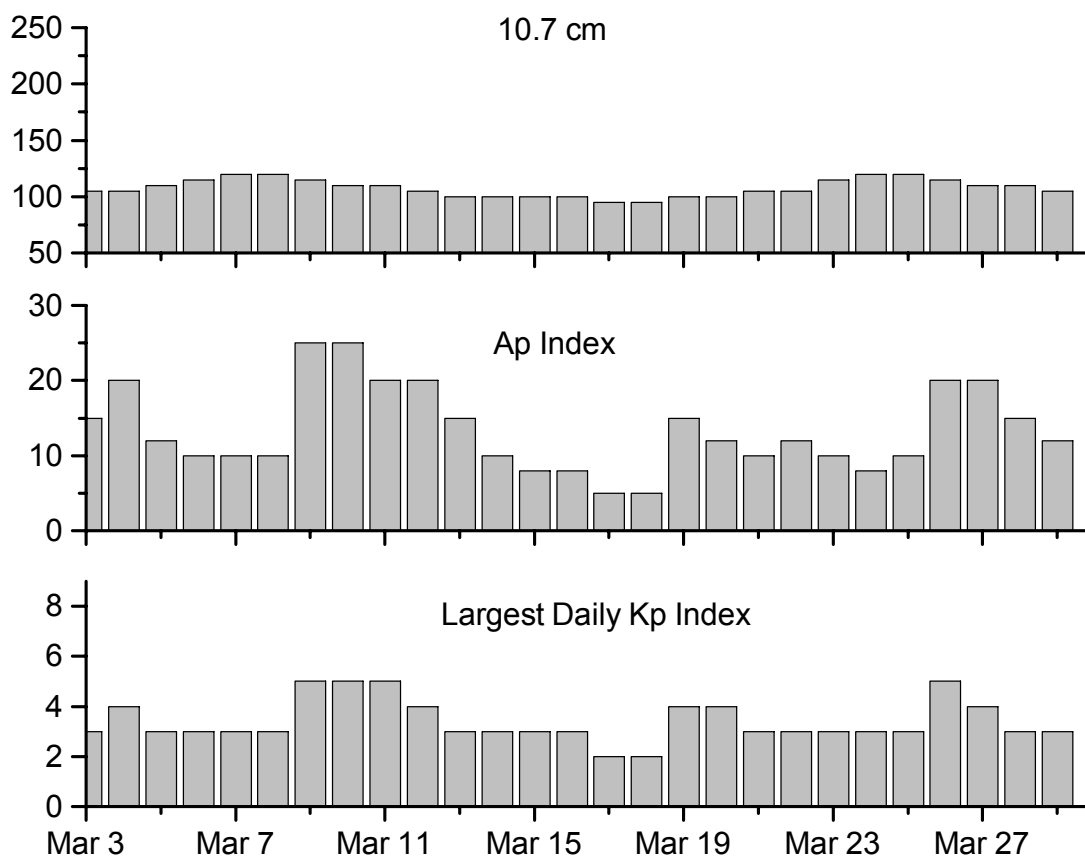


Alerts and Warnings Issued

Date & Time of Issue	Type of Alert or Warning	Date & Time of Event UT
24 Feb 0006	2 – 245 MHz Radio Bursts	23 Feb
24 Feb 1341	ALERT: Electron 2MeV Integral Flux > 1000pfu	24 Feb 1320
25 Feb 0031	1 – 245 MHz Radio Burst	24 Feb
25 Feb 0031	1 – 245 MHz Radio Noise Storm	24 Feb
26 Feb 0011	3 – 245 MHz Radio Bursts	25 Feb
26 Feb 0011	1 – 245 MHz Radio Noise Storm	25 Feb
26 Feb 0159	ALERT: X-Ray Flux exceeded M5	26 Feb 0159
26 Feb 0213	SUMMARY: X-ray Event > X1	26 Feb 0150
26 Feb 2303	ALERT: X-Ray Flux > M5	26 Feb 2228
26 Feb 2306	SUMMARY: X-ray Event > M5	26 Feb 2214
27 Feb 0045	1 – 245 MHz Radio Burst	26 Feb
25 Feb 0045	1 – 245 MHz Radio Noise Storm	26 Feb
27 Feb 0344	SUMMARY: Geomagnetic Sudden Impulse	27 Feb 0340
27 Feb 0346	WARNING: Geomagnetic K= 4 expected	27 Feb 0346 - 1600
27 Feb 0438	ALERT: Geomagnetic K= 4	27 Feb 0437
27 Feb 2017	ALERT: Geomagnetic K = 4	27 Feb 2014
27 Feb 2316	ALERT: Geomagnetic K = 4	27 Feb 2310
27 Feb 2318	WARNING: Geomagnetic K = 4	27 Feb 2320 – 28 Feb 1600
28 Feb 0653	ALERT: Geomagnetic K = 5	28 Feb 0653
28 Feb 1547	EXTENDED WARNING: Geomagnetic K= 4	27 Feb 2320 – 28 Feb 2359
28 Feb 2104	WATCH: Geomagnetic A \geq 20	28 Feb
28 Feb 2109	WATCH: Geomagnetic A \geq 20	29 Feb
28 Feb 2116	WATCH: Geomagnetic A \geq 20	01 Mar
28 Feb 2355	WARNING: Geomagnetic K= 5	28 Feb 2355 – 29 Feb 1600
29 Feb 0031	1 – 245 MHz Radio Burst	28 Feb
29 Feb 1117	ALERT: Geomagnetic K= 4	29 Feb 1116
29 Feb 1127	ALERT: Geomagnetic K= 5	29 Feb 1126
29 Feb 2037	ALERT: Geomagnetic K= 4	29 Feb 2035



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 Mar	105	15	3	17 Mar	95	5	2
04	105	20	4	18	95	5	2
05	110	12	3	19	100	15	3
06	115	10	3	20	100	12	3
07	120	10	3	21	105	10	3
08	120	10	3	22	105	12	3
09	115	25	5	23	115	10	3
10	110	25	5	24	120	8	3
11	110	20	5	25	120	10	3
12	105	20	4	26	115	20	5
13	100	15	3	27	110	20	4
14	100	10	3	28	110	15	3
15	100	8	3	29	105	12	3
16	100	8	3				



Energetic Events

Date	Time		X-ray		Optical Information			Peak		Sweep Freq		
	Begin	Max	½ Max	Class	Integ Flux	Imp/ Brtns	Location Lat CMD	Rgn #	Radio Flux		Intensity	
									245	2695	II	IV
26 Feb	0150	0203	0210	X1.1	.070	2n	N14W15	564				
26 Feb	2214	2230	2239	M5.7	.045	1n	N14W26	564				

Flare List

Date	Time			X-ray Class.	Optical		Rgn
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
23 February	0043	0047	0049	B4.5	564		
	0540	0552	0601	B3.7			
	1214	1218	1223	B3.0			
	1404	1408	1414	B2.6		564	
	1733	1739	1744	B3.3			
	2152	2155	2157	B1.9		564	
24 February	0555	0557	0559		Sf	N16E12	564
	2325	2325	2330	B7.1	Sf	N13E02	564
	2342	2346	2349	B7.1			564
25 February	0022	0038	0056		Sf	N16E02	564
	0058	0103	0106		Sf	N16E02	564
	0205	0207	0219	C2.4	Sf	N16E01	564
	0249	0257	0319	B6.4			564
	0426	0426	0430	B8.9	Sf	N13W03	564
	0448	0451	0457	B5.8			
	0508	0514	0521	B9.8	Sf	N14W03	564
	0526	0531	0535	C1.0	Sf	N14W03	564
	0635	0637	0640		Sf	S05E15	565
	0646	0652	0656	C1.3			564
	1042	1047	1051	C1.1			564
	1107	1126	1136	C1.3			564
	1211	1225	1237	C8.0			564
	1414	1418	1423	B4.2			564
26 February	1523	1531	1536	B7.8			564
	1615	1615	1632	C2.6	Sf	N13W09	564
	2309	2313	2337	C2.6	Sf	N14W16	564
	0103	0106	0119	C1.8	Sf	N14W14	564
	0154	0202	0244	X1.1	2n	N14W15	564
	0445	0448	0500	C1.6	Sf	N14W15	564
	0530	0539	0548	C2.4			564
	1248	1252	1257	B4.2			564
	1334	1339	1342	B5.1			564
	1409	1420	1423	C6.5			564
	1621	1626	1628	B7.8			564
2012	2016	2037	C7.5	Sf	N14W25	564	



Flare List – continued.

Date	Time			X-ray Class.	Optical		Rgn
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
26 February	2146	2149	2151	B4.5			
	2217	2225	2306	M5.7	1n	N14W26	564
27 February	0015	0018	0025	B5.1			564
	0220	0223	0227	B4.9			564
	0653	0658	0700	B7.1			
	0843	0851	0856	C2.5			564
	0938	0942	0945	B4.3			564
28 February	1406	1410	1415	B8.0			564
	0123	0127	0138	B7.4			567
	0323	0324	0327	B6.6			564
	0404	0410	0419	B4.0			564
	0758	0803	0807	B3.6			564
	1129	1153	1157	C2.2			567
	1705	1710	1713	C1.6			567
	1723	1727	1730	C2.9			564
	1920	1924	1926	B5.4			567
29 February	0614	0617	0620	B4.8			564

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 560

15 Feb	S16E30	248	0020	01	Axx	001	A								
16 Feb	S17E17	248	0010	03	Cso	002	B								
17 Feb	S17E04	248													
18 Feb	S17W09	248													
19 Feb	S17W22	248													
20 Feb	S17W35	248													
21 Feb	S17W48	248													
22 Feb	S17W61	248													
23 Feb	S17W74	248													
24 Feb	S17W87	248													

0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude:248



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	4

Region 561

15 Feb	N02E64	214	0030	02	Hrx	001	A								
16 Feb	N02E52	213	0030	01	Hsx	001	A								
17 Feb	N02E39	213	0030	02	Hsx	001	A								
18 Feb	N02E26	213	0020	02	Hsx	002	A								
19 Feb	N02E12	213	0030	01	Hsx	001	A								
20 Feb	N02W01	213	0010	01	Hsx	001	A								
21 Feb	N02W15	214	0020	01	Axx	002	A								
22 Feb	N02W30	216	0010	01	Axx	001	A								
23 Feb	N02W43	216													
24 Feb	N02W56	216													
25 Feb	N02W69	216													
26 Feb	N02W82	216													

0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude:213

Region 562

19 Feb	S11E73	152	0010	01	Axx	001	A								
20 Feb	S11E59	153	0060	08	Dao	002	B								
21 Feb	S13E45	154	0020	07	Bxo	002	B								
22 Feb	S12E29	157	0010	01	Axx	001	A								
23 Feb	S13E13	160	0000	00	Axx	001	A								
24 Feb	S13E00	160													
25 Feb	S12W09	155	0010	03	Bxo	002	B								
26 Feb	S12W22	155													
28 Feb	S12W48	155													
29 Feb	S09W61	155													

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude:160



Region Summary - continued.

Date	Location		Sunspot Characteristics				Flares			X-ray				Optical			
	(° Lat ° CMD)	Helio Lon	Area (10 ⁻⁶ hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	C	M	X	S	1	2	3	4		

Region 563

20 Feb	S21E66	146	0030	01	Axx	001	A								
21 Feb	S24E51	148	0020	01	Axx	001	A								
22 Feb	S23E40	146	0030	01	Hsx	001	A								
23 Feb	S24E26	147	0010	01	Hrx	001	A								
24 Feb	S24E13	147	0030	02	Hsx	002	A								
25 Feb	S23E01	145	0030	02	Hsx	002	A								
26 Feb	S23W12	145	0010	01	Hsx	001	A								
27 Feb	S23W27	147	0010	01	Axx	001	A								
28 Feb	S23W39	146	0020	02	Cso	002	B								
29 Feb	S23W52	146													

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude:145

Region 564

21 Feb	N14E42	157	0020	06	Bxo	007	B								
22 Feb	N13E26	160	0180	11	Eai	015	Bg	5			10				
23 Feb	N13E13	160	0300	12	Eko	020	Bg								
24 Feb	N15E00	160	0470	11	Eki	027	Bg				2				
25 Feb	N14W14	160	0540	11	Ekc	039	Bg	8			8				
26 Feb	N14W27	160	0650	11	Ekc	051	Bgd	5	1	1	3	1	1		
27 Feb	N14W42	162	0870	11	Ekc	029	Bg	1							
28 Feb	N15W54	161	0780	11	Ekc	028	Bg	1							
29 Feb	N13W67	161	0650	12	Eai	016	Bg								

20 1 1 23 1 1 0 0

Still on Disk.

Absolute heliographic longitude:160



Region Summary - continued.

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

Region 565

23 Feb	S05E35	138	0050	06	Dro	006	B											
24 Feb	S04E22	138	0120	07	Cao	013	B											
25 Feb	S05E07	139	0180	08	Cao	013	B					1						
26 Feb	S05W07	140	0130	07	Dai	023	B											
27 Feb	S04W21	141	0190	08	Dko	015	B											
28 Feb	S04W33	140	0180	09	Dao	011	B											
29 Feb	S04W51	145	0100	05	Dao	006	B											
												0	0	0	1	0	0	0

Still on Disk.

Absolute heliographic longitude:139

Region 566

24 Feb	N05E21	139	0020	04	Cro	003	B											
25 Feb	N05E05	141	0010	01	Axx	001	A											
26 Feb	N05W08	141																
												0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:141

Region 567

27 Feb	S13E50	070	0040	06	Cso	005	B											
28 Feb	S13E37	070	0070	08	Dao	009	B	2										
29 Feb	S13E24	070	0120	09	Dao	016	B											
												2	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:070

Region 568

28 Feb	S16W20	127	0020	04	Bxo	004	B											
29 Feb	S17W32	126	0010	03	Bxo	003	B											
												0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:127

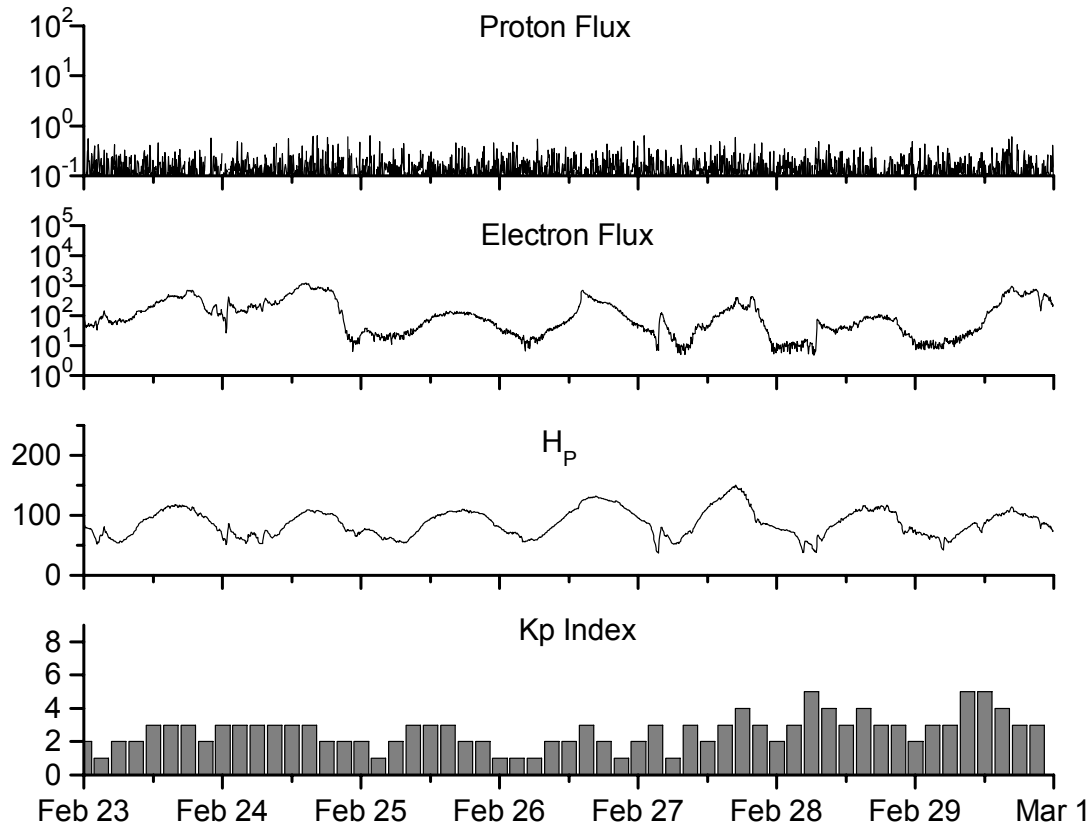


**Recent Solar Indices (preliminary)
of the observed monthly mean values**

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
2002									
February	194.5	107.4	0.55	188.6	114.7	205.0	197.2	10	12.8
March	153.1	98.4	0.64	188.9	113.3	180.3	195.7	10	12.9
April	194.9	120.7	0.62	186.2	110.5	189.8	191.5	15	13.2
May	204.1	120.8	0.59	183.6	108.9	178.4	188.0	15	13.3
June	146.0	88.3	0.60	179.9	106.3	148.7	183.0	11	13.5
July	183.5	99.6	0.54	175.4	102.7	173.5	176.3	11	13.7
August	191.0	116.4	0.61	169.2	98.7	183.9	169.5	16	14.2
September	206.4	109.6	0.53	163.4	94.6	175.8	164.1	14	15.0
October	153.9	97.5	0.63	158.8	90.5	167.0	159.4	23	15.6
November	159.8	95.5	0.60	150.9	85.2	168.7	154.8	16	16.3
December	147.9	80.8	0.55	144.6	82.1	158.6	150.9	13	17.0
2003									
January	149.3	79.7	0.53	141.7	81.0	144.0	149.2	13	18.2
February	87.0	46.0	0.53	136.4	78.5	124.5	144.7	17	18.9
March	119.7	61.1	0.51	128.1	74.2	132.2	139.5	21	19.4
April	119.7	60.0	0.50	121.5	70.3	126.3	136.3	20	20.0
May	89.6	55.2	0.62	118.3	67.8	129.3	135.0	26	21.0
June	118.4	77.4	0.65	113.6	65.2	129.4	132.6	24	21.8
July	132.8	85.0	0.64	106.9	62.0	127.8	129.5	20	22.3
August	114.3	72.7	0.64			122.1		23	
September	82.6	48.8	0.59			112.3		19	
October	118.9	65.6	0.55			153.1		32	
November	118.9	67.2	0.57			153.1		31	
December	75.4	47.0	0.62			115.1		18	
2004									
January	62.3	37.2	0.60			114.1		20	

NOTE: All smoothed values after September 2002 and monthly values after March 2003 are preliminary estimates. The lowest smoothed sunspot index number for Cycle 22, RI = 8.0, occurred in May 1996. The highest smoothed sunspot number for Cycle 23, RI= 120.8, occurred April 2000. *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 23 February 2004

Protons plot contains the five-minute averaged integral proton flux (protons/cm²-sec -sr) as measured by

GOES-11 (W113) for each of three energy thresholds: greater than 10, 50, and 100 MeV.

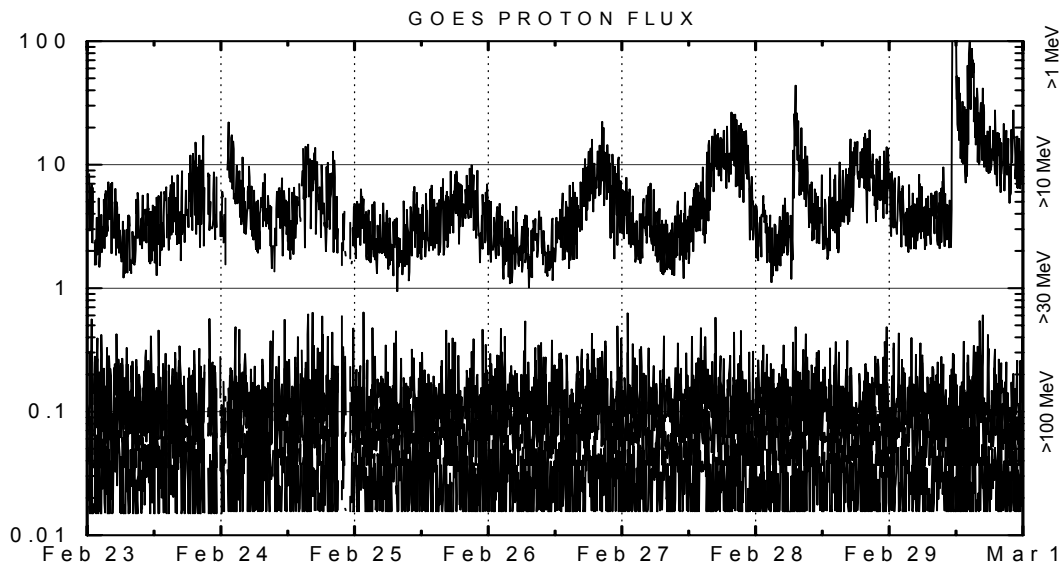
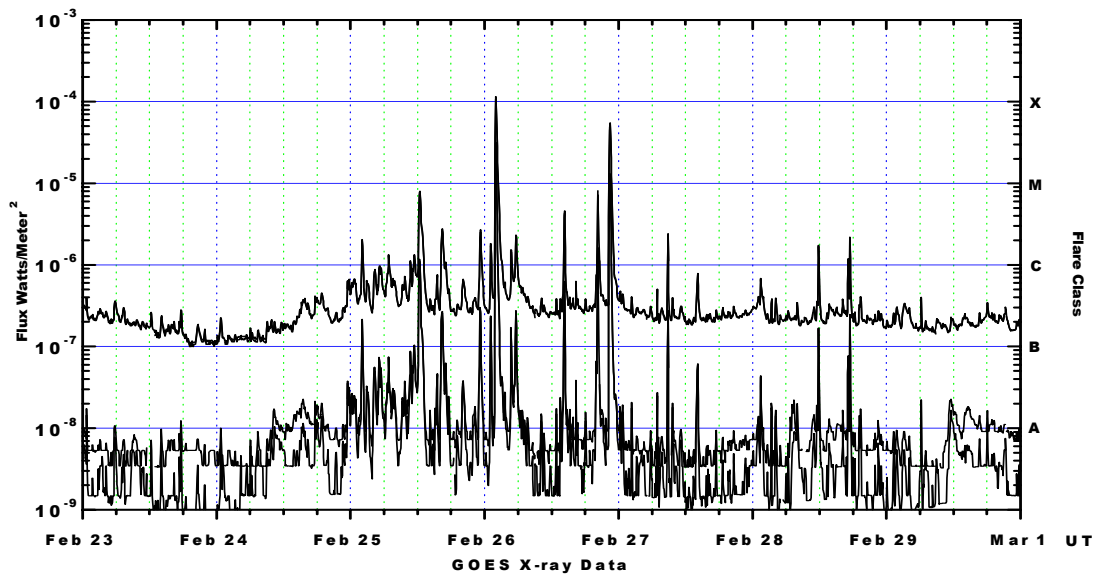
Electrons plot contains the five-minute averaged integral electron flux (electrons/cm²-sec -sr) with energies greater than 2 MeV at GOES-12.

H_p plot contains the five minute averaged magnetic field H - component in nanoteslas (nT) as measured by GOES-12. 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 Air Force Weather Agency) 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 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 12 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-11 (W113) 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.

