

Space Weather Highlights
15 – 21 March 2004

SWO PRF 1490
23 March 2004

Solar activity ranged from low to moderate with the bulk of this period's activity originating from two new regions, regions 574 and 578. Region 574 (S04, L=177, class/area, Esi/120 on 20 March) rotated onto the disk on 16 March and produced this period's largest event, an M1.6/2b flare on 18/0517 UTC. The most active region on the disk was Region 578 (N15, L=144, class/area, Eao/180 on 21 March) that rotated onto the disk on 18 March. Since first appearing, Region 578 has produced 20 mostly low-level C-class flares and one M-class flare; an M1.5/1f on 18/2236 UTC. Both regions exhibited slow, steady growth as they transited the disk. During the period, 4 CME's were clearly visible in LASCO imagery, but none were Earth directed.

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 velocities at speeds averaging 450 km/s with a brief spike to 550 km/s midday on 16 March. By 17 March, wind speeds began to gradually decrease and weakened to just over 325 km/s by early on 19 March. Thereafter, wind velocities began another gradual increase, ending the summary period at about 425 km/s. The elevated solar wind speeds early in the period were driven by remnants of a favorably positioned, recurrent coronal hole and by 17 March, effects of the coronal hole were gone. The Bz component of the interplanetary magnetic field did not vary much beyond +/- 5 nT for the entire period.

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 was at high levels for the entire summary period.

The geomagnetic field ranged from mostly quiet to unsettled levels with isolated active periods observed early on 15 March and again midday, at high latitudes, on 21 March. The early active period was due to waning effects of the previous week's large coronal hole.

Space Weather Outlook
24 March - 19 April 2004

Solar activity is expected to range from low to moderate levels throughout the forecast period. Isolated moderate activity is possible from Region 574 until its departure on 29 March and from Region 578 until its departure on 31 March. From 31 March through 11 April, activity should be at mostly very low to low levels. Solar activity is expected to increase to low to moderate levels after old regions 574 (11 April) and 578 (13 April) return.

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 from 27 to 29 March, 06 to 11 April and again on 19 April due to recurrent coronal holes.

Geomagnetic activity is expected to range from quiet to minor storm levels. A weak coronal hole high-speed stream is due to return on 26 – 27 March and is expected to produce unsettled to active conditions. A large, recurrent coronal hole high-speed stream is due to return on 05 – 09 April and is expected to produce active to minor storm conditions. Unsettled to active conditions are expected on 17 to 18 April due to weak coronal hole high-speed 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
15 March	101	49	350	B1.3	0	0	0	0	0	0	0	0
16 March	110	53	320	B1.7	0	0	0	0	0	0	0	0
17 March	110	101	450	B2.9	4	0	0	3	0	0	0	0
18 March	115	107	450	B3.9	8	2	0	5	1	1	0	0
19 March	112	89	350	B4.2	11	0	0	6	0	0	0	0
20 March	114	82	380	B2.7	2	0	0	1	0	0	0	0
21 March	111	65	320	B1.6	4	0	0	3	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
	15 March	6.2E+5	1.2E+4	2.8E+3		3.2E+8
16 March	4.0E+5	1.3E+4	2.9E+3		2.6E+8	
17 March	2.9E+5	1.3E+4	2.7E+3		2.2E+8	
18 March	2.7E+5	1.3E+4	2.9E+3		6.0E+7	
19 March	3.2E+5	1.3E+4	2.7E+3		5.7E+7	
20 March	3.9E+5	1.4E+4	2.9E+3		6.9E+7	
21 March	4.7E+5	1.4E+4	2.8E+3		2.9E+7	

Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	15 March	11	4-3-1-2-3-1-2-2	19	3-2-2-4-5-4-3-2	13
16 March	6	2-1-0-2-2-2-2-2	11	3-2-1-4-2-3-1-2	8	3-2-1-3-2-3-2-2
17 March	5	2-2-0-0-1-3-1-1	5	1-2-1-3-1-1-1-0	6	1-2-1-2-2-3-2-1
18 March	8	3-3-1-2-2-2-1-2	14	2-3-4-3-4-2-2-2	10	3-3-3-3-3-2-2-2
19 March	5	2-3-1-1-1-0-1-2	5	2-2-0-3-2-1-1-1	6	2-3-0-2-2-2-2-2
20 March	7	2-3-1-1-2-2-2-2	11	2-3-2-2-3-4-1-1	9	3-3-1-2-2-3-2-2
21 March	9	3-3-2-2-2-2-2-2	22	3-2-2-6-4-4-2-1	13	3-3-3-4-3-2-3-2

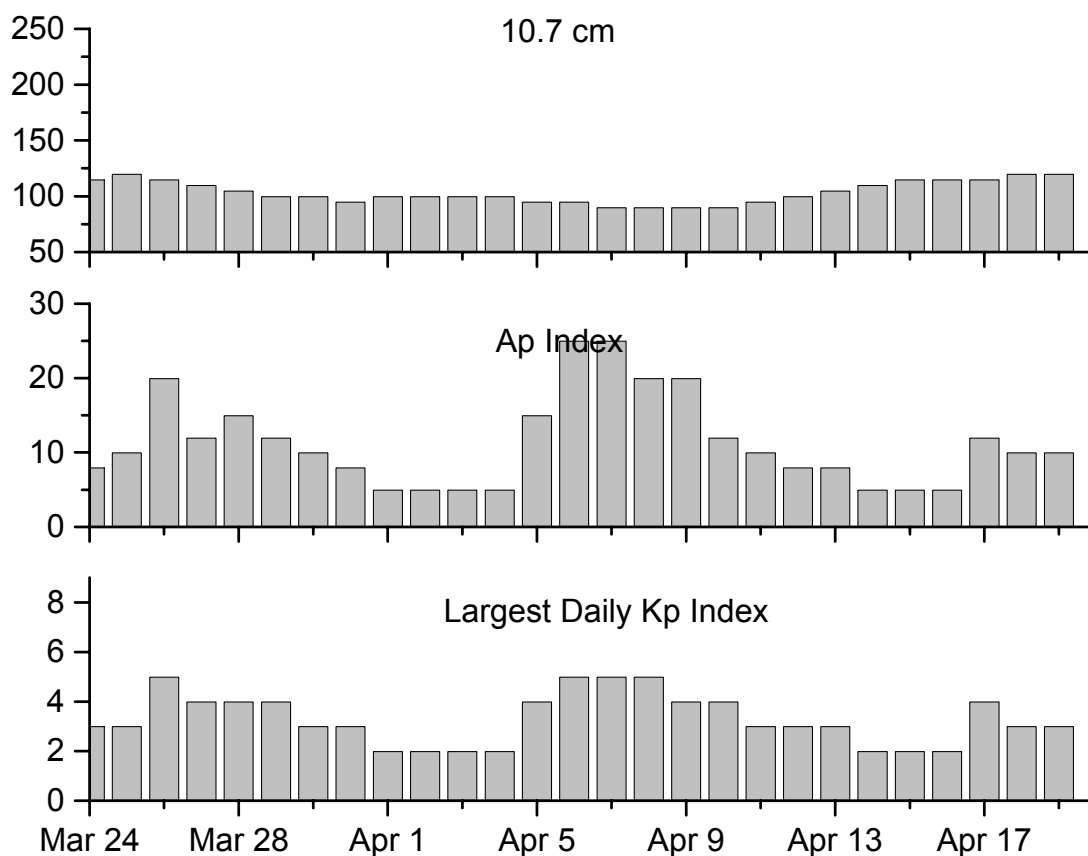


Alerts and Warnings Issued

<u>Date & Time of Issue</u>	<u>Type of Alert or Warning</u>	<u>Date & Time of Event UT</u>
15 Mar 0238	WARNING: Geomagnetic K= 4	15 Mar 0238 - 1600
15 Mar 0241	ALERT: Geomagnetic K= 4	15 Mar 0240
15 Mar 0246	ALERT: Geomagnetic K= 5	15 Mar 0244
15 Mar 0908	ALERT: Electron 2MeV Integral Flux > 1000pfu	15 Mar 0835
17 Mar 0013	1 – 245 MHz Radio Burst	16 Mar
16 Mar 0525	ALERT: Electron 2MeV Integral Flux > 1000pfu	16 Mar 0510
17 Mar 0516	ALERT: Electron 2MeV Integral Flux > 1000pfu	17 Mar 0500
17 Mar 0955	ALERT: Type II Radio Emission	17 Mar 0930
18 Mar 0006	1 – 245 MHz Radio Burst	17 Mar
18 Mar 0136	WARNING: Geomagnetic K= 4	18 Mar 0138 - 1600
18 Mar 0147	ALERT: Geomagnetic K= 4	18 Mar 0145
18 Mar 1517	ALERT: Electron 2MeV Integral Flux > 1000pfu	18 Mar 1455
19 Mar 1317	ALERT: Electron 2MeV Integral Flux > 1000pfu	19 Mar 1255
20 Mar 0505	ALERT: Geomagnetic K= 4	20 Mar 0502
20 Mar 1321	ALERT: Electron 2MeV Integral Flux > 1000pfu	20 Mar 1300
21 Mar 1207	ALERT: Electron 2MeV Integral Flux > 1000pfu	21 Mar 1145



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
24 Mar	115	8	3	07 Apr	90	25	5
25	120	10	3	08	90	20	5
26	115	20	5	09	90	20	4
27	110	12	4	10	90	12	4
28	105	15	4	11	95	10	3
29	100	12	4	12	100	8	3
30	100	10	3	13	105	8	3
31	95	8	3	14	110	5	2
01 Apr	100	5	2	15	115	5	2
02	100	5	2	16	115	5	2
03	100	5	2	17	115	12	4
04	100	5	2	18	120	10	3
05	95	15	4	19	120	10	3
06	95	25	5				



Energetic Events

Date	Time		X-ray	Optical Information			Peak		Sweep Freq	
	Begin	Max	Integ	Imp/	Location	Rgn	Radio Flux		Intensity	
			Class	Flux	Lat	CMD	#	245	2695	II

No Events Observed

Flare List

Date	Time			X-ray Class.	Imp / Brtns	Optical	Rgn
	Begin	Max	End			Location Lat CMD	
15 March	1059	1103	1107	B2.6			
	1725	1728	1731	B2.0			
16 March	1550	1559	1606	B7.2			573
17 March	0150	0156	0201	B3.1			572
	0550	0558	0604	B7.8			574
	0640	0643	0645	B3.1			576
	0753	0800	0814	C1.5	Sf	S05E64	574
	0831	0833	0844		Sf	S05E63	574
	0918	0931	0944	C1.6			572
	1419	1427	1448	C2.5			574
	1613	1617	1621	B9.8			574
	1800	1812	1818	C1.3			574
	2137	2137	2142	B6.4	Sf	S04E57	574
18 March	0021	0031	0038	B5.4			574
	0056	0100	0105	B6.8			574
	0116	0120	0124	B6.9			574
	0126	0133	0139	C1.4			578
	B0511	0516	0541	M1.6	2b	S03E51	574
	0558	0605	0611	C3.7			578
	0612	0613	0644	C8.0	Sf	S06E50	574
	0944	0950	0956	C1.2			574
	1202	1222	1234	C3.1			578
	1322	1327	1330	B8.6			578
	1441	1446	1450	C2.7			578
	1926	1927	1930	C3.7	Sf	N18E83	578
	2205	2239	2259	C1.2	Sf	N12E79	578
	B2225	2239	2243	M1.5	1f	N16E78	578
B2251	2301	2302		Sf	N16E75		
2305	2306	2310		Sf	N12E79	578	
19 March	B0013	0018	0020		Sf	N16E76	
	0112	0117	0127	C1.8			578
	0230	0236	0240	C2.0			578
	0258	0306	0314	C1.4			578
	0415	0415	0422	C1.2	Sf	S06E37	574
	0604	0605	0613		Sf	N11E71	578



Flare List – continued.

Date	Time			X-ray Class.	Optical		Rgn
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
19 March	0609	0610	0614		Sf	S06E36	574
	0736	0744	0749	C1.1			578
	0847	0848	0853	C2.4	Sf	S05E37	574
	1003	1012	1024	C1.7	578		
	1038	1042	1051	C1.4	578		
	1211	1317	1339	C2.5	578		
	1508	1524	1531	B8.3	577		
	1630	1637	1645	C1.6	578		
	1826	1832	1838	C1.0	578		
		B2116	2116	2137	B8.7	Sf	N13E59
20 March	0626	0626	0630	B7.5	Sf	N14E56	578
	1426	1429	1433	B7.0			578
	1546	1550	1556	B3.9			578
	1658	1702	1707	B8.5			578
	1851	1858	1908	B7.7			578
	1917	1921	1925	B6.1			578
	1959	2025	2035	C1.7			578
21 March	0002	0009	0023	C2.0	Sf	N15E46	578
	0115	0115	0121	C1.0	Sf	N15E48	578
	0939	0952	1002	C6.3			576
	1059	1113	1138	B8.7			578
	1538	1546	1601	B4.8			578
	1632	1637	1642	C1.3	Sf	N16E39	578
	1840	1855	1906	B5.8			578
	2018	2033	2044	C1.1			578



Region Summary

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 570

05 Mar S13E84	304	0100	03	Hkx	001	A	3												
06 Mar S13E70	305	0340	17	Cko	007	B	4	1											
07 Mar S14E59	302	0570	14	Ekc	009	B													
08 Mar S14E46	302	0750	20	Fko	019	Bg	1												
09 Mar S14E34	301	0640	18	Fho	019	Bg	2				2								
10 Mar S14E20	302	0730	10	Fko	021	Bg					1								
11 Mar S13E07	303	0580	20	Fko	033	Bgd	1				1								
12 Mar S14W05	301	0550	18	Fao	023	Bgd	2				2								
13 Mar S13W20	303	0390	18	Fho	019	Bgd	1												
14 Mar S13W32	302	0340	19	Fho	018	Bg													
15 Mar S14W46	303	0230	17	Fko	009	Bg													
16 Mar S14W66	310	0220	07	Dso	004	Bg													
17 Mar S14W80	310	0200	09	Dko	003	Bg													
18 Mar S14W93	310	0120	06	Dso	002	Bg													
							14	1	0	6	0	0	0	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude:301

Region 571

10 Mar S14W13	335	0010	01	Bxo	002	B												
11 Mar S14W27	337	0010	03	Bxo	003	B												
12 Mar S14W40	337																	
13 Mar S14W53	337																	
14 Mar S14W66	337																	
15 Mar S14W79	337																	
16 Mar S14W92	337																	
							0	0	0	0	0	0	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude:335

Region 572

12 Mar N19W05	301	0020	04	Cso	006	B												
13 Mar N19W19	302	0110	05	Dao	010	B												
14 Mar N19W32	302	0100	05	Dso	011	B												
15 Mar N19W45	302	0090	05	Cso	008	B												
16 Mar N19W58	302	0040	01	Hsx	001	A												
17 Mar N19W72	302	0040	02	Hsx	001	A	1											
18 Mar N19W87	304																	
							1	0	0	0	0	0	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude:301



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 573

12 Mar S14E71	225	0080	04	Hsx	001	A								
13 Mar S12E57	226	0070	02	Hax	002	A								
14 Mar S13E44	226	0050	02	Hax	002	A								
15 Mar S12E33	224	0030	01	Hax	002	A								
16 Mar S12E20	224	0020	04	Cso	004	B								
17 Mar S12E06	224	0010	03	Bxo	002	B								
18 Mar S12W07	224	0010	01	Axx	001	A								
19 Mar S12W22	226	0010	01	Axx	001	A								
20 Mar S12W35	226													
21 Mar S12W48	226													

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude:224

Region 574

16 Mar S02E70	174	0040	05	Cso	004	B								
17 Mar S02E56	174	0110	08	Dsi	018	Bg	3			3				
18 Mar S02E43	174	0160	09	Dac	021	Bg	2	1		1		1		
19 Mar S04E28	176	0140	10	Dac	020	Bg	2			3				
20 Mar S04E14	177	0120	11	Esi	022	Bg								
21 Mar S04E01	177	0100	11	Esi	020	Bg								

7 1 0 7 0 1 0 0

Still on Disk.

Absolute heliographic longitude:177

Region 575

17 Mar S18W02	232	0010	03	Bxo	003	B								
18 Mar S18W15	232	0020	04	Cao	004	B								
19 Mar S15W25	229													
20 Mar S15W38	229													
21 Mar S15W51	229													

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude:232



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 576

17 Mar	S18W38	268	0020	04	Cso	003	B								
18 Mar	S18W51	268	0040	06	Dao	006	B								
19 Mar	S18W65	269	0050	05	Dao	006	B								
20 Mar	S07W78	269	0030	05	Cro	003	B								
21 Mar	S07W91	269								1					
										1	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:268

Region 577

17 Mar	S01E77	153	0060	02	Hsx	001	A								
18 Mar	N00E09	208	0040	02	Hax	001	A								
19 Mar	S01E52	152	0070	02	Hsx	001	A								
20 Mar	S01E39	152	0070	02	Hsx	001	A								
21 Mar	N00E27	151	0040	02	Hsx	001	A								
										0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:208

Region 578

18 Mar	N15E76	141	0060	02	Hax	002	A	6	1		3	1			
19 Mar	N15E60	144	0080	09	Dao	011	B	9			2				
20 Mar	N15E47	144	0160	10	Dsc	016	B	2			1				
21 Mar	N15E34	144	0180	12	Eao	014	B	3			3				
								20	1	0	9	1	0	0	0

Still on Disk.

Absolute heliographic longitude:144

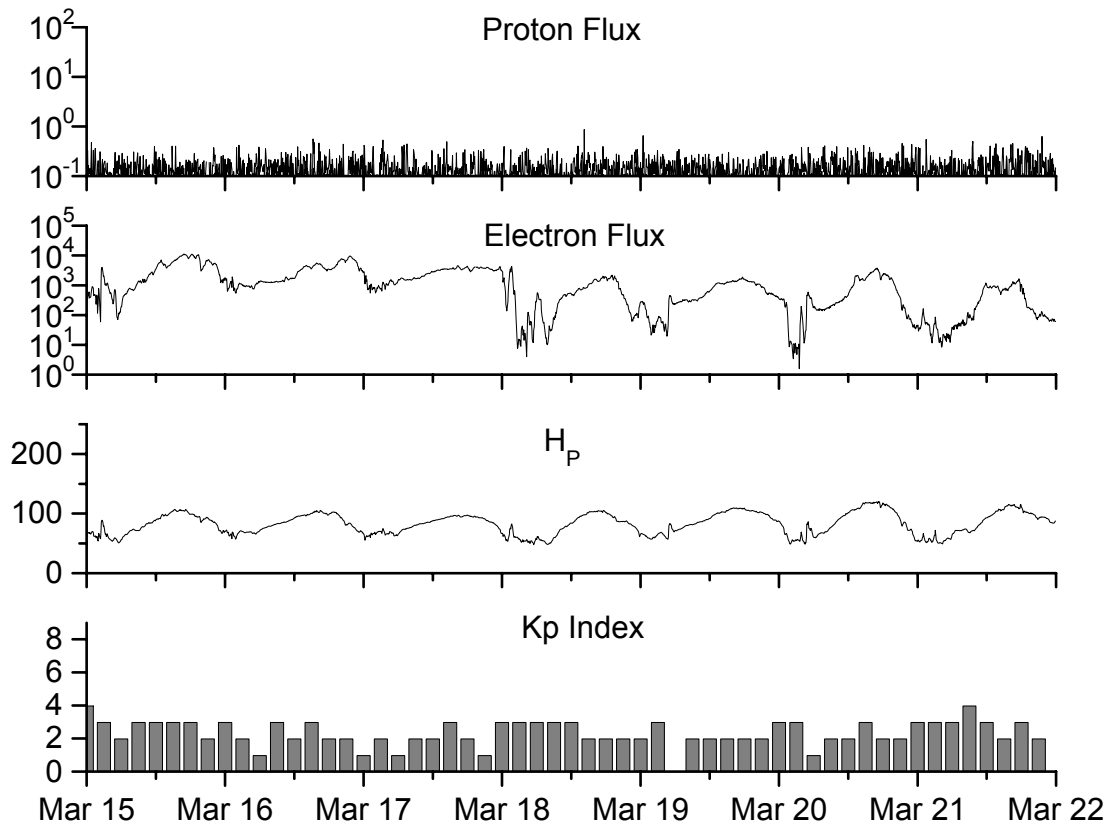


**Recent Solar Indices (preliminary)
of the observed monthly mean values**

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									
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	102.8	60.3	122.1	127.5	23	22.4
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	
February	75.6	46.0	0.61			107.0		13	

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 08 March 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.

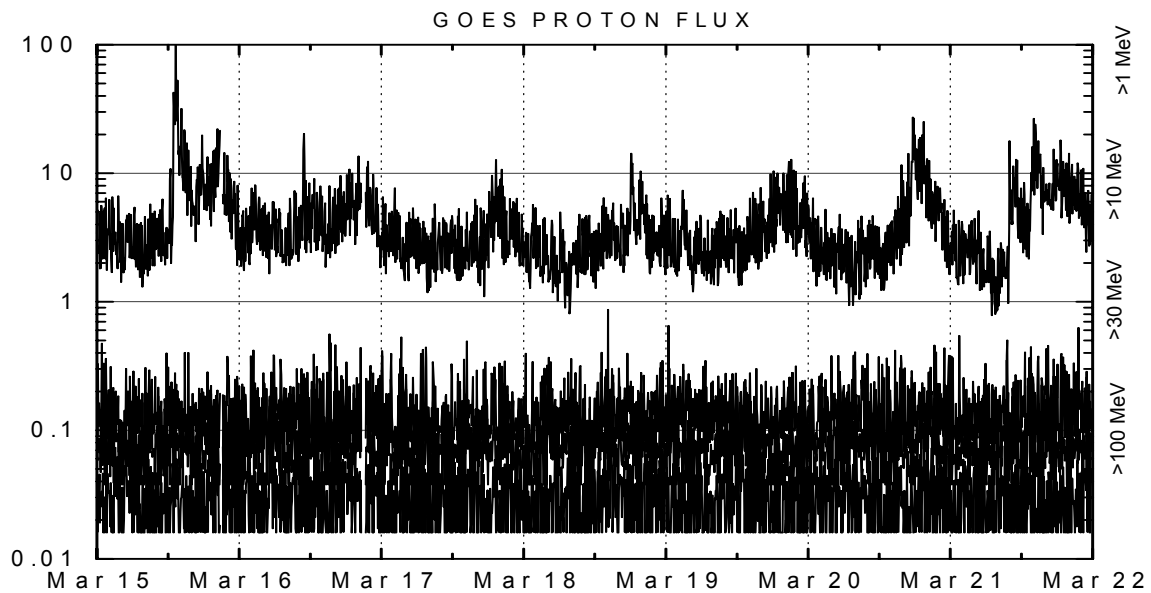
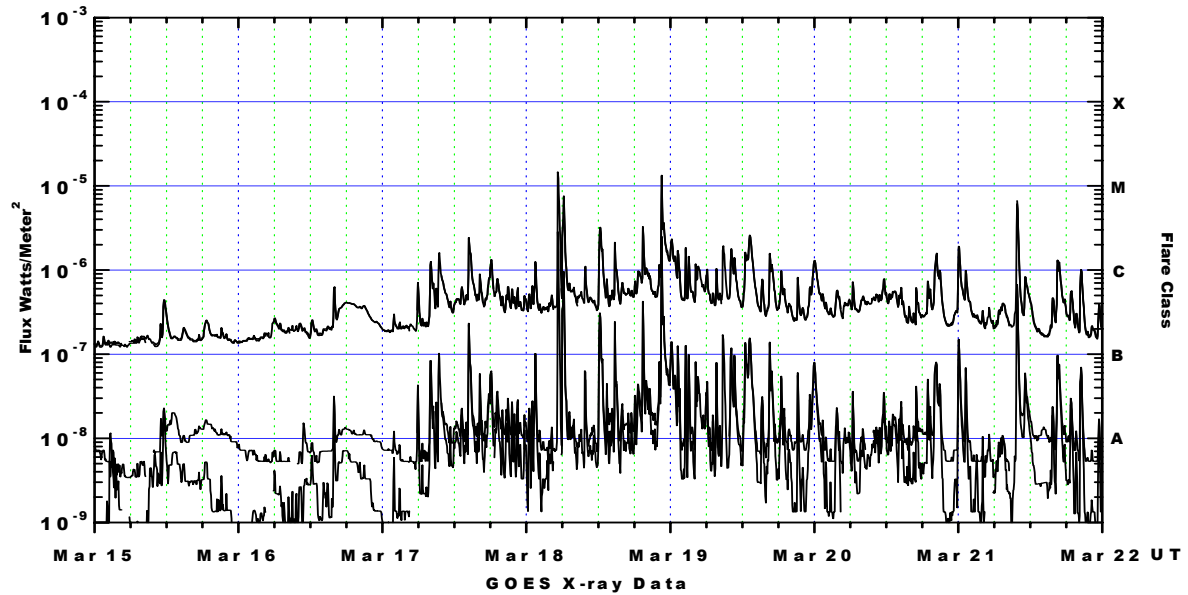
Electrons plot contains the five-minute averaged integral electron flux (electrons/cm²-sec -sr) with energies greater than 2 MeV at GOES-12.

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_p 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.

