Space Weather Highlights **SWO PRF 1442**
14 - 20 April 2003 **22 April 2003**

Solar activity ranged from very low to moderate levels. The period began with low level activity on 14 April and very low activity on 15 – 17 April. Region 337 (S12, L= 245, class/area Dko/340 on 20 April) rotated onto the visible disk on 18 April in a growth phase, developing both area coverage and magnetic complexity through 20 April. On 18 April, activity reached moderate levels with Region 337 producing an M1/Sf flare at 1958 UTC. At the end of the period, 19 – 20 April, activity returned to low levels. Early on 19 April, a long duration C1 flare was observed on the east limb. On 20 April, Region 339 (N18, L=338, class/area Cso/20 on 20 April) appeared on the disk and rapidly developed a beta-gamma magnetic configuration. Activity from Region 339 consisted of low C-class flares, the largest being a C4/Sf at 1923 UTC on 20 April.

Solar wind data were available from the NASA Advanced Composition Explorer (ACE) spacecraft for most of the summary period. On 14 April, a co-rotating interacting region marked the onset of a large southern coronal hole high speed stream. Bz rotated from negative 10 nT to positive 10 nT before entering a typical oscillating pattern and solar wind speed increased from 500 km/s to near 650 km/s. Solar wind continued to increase on 15 – 16 April and reached a peak value near 800 km/s by midday on the 16th. Solar wind velocity began to decline on 17 April and slowly decreased for the remainder of the period. At the end of the period, velocity was back around 500 km/s.

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

The greater than 2 MeV electron flux at geo-synchronous orbit reached high levels on 15 – 20 April.

The geomagnetic field ranged from quiet to major storm levels. Activity from the large southern coronal hole high speed stream began late on 14 April with the arrival of a co-rotating interacting region that produced an isolated minor storm period followed by unsettled to active conditions. For the next four days, 15 – 18 April, activity from this high speed stream was at unsettled to minor storm levels with an isolated major storm period on 16 April. By 19 April, activity had subsided to unsettled levels. The period ended on 20 April with quiet to active levels due to elevated solar wind speed and a prolonged period of southward Bz.

Space Weather Outlook
23 April 2003 - 19 May 2003

Solar activity is expected to range from very low to moderate levels. With a number of new regions returning to the visible disk, C-class activity is expected with a chance of isolated M-class events. New Regions 337, 338 (S19, L=280, class/area Dso/40 on 20 April), and 339 are all quite active and exhibit some magnetic complexity.

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

The greater than 2 MeV electron flux may reach high levels on 27 – 28 April, 02 – 03 May, 08 – 10 May, and again on 15 – 19 May. These high flux levels are all due to returning coronal holes.

The geomagnetic field is expected to range from quiet to major storm levels. Activity early in the period is expected to be unsettled to isolated major storm levels due to a combination of a returning coronal hole on 23 April and a weak CME shock. Unsettled to active conditions with the possibility of isolated minor storming is expected to continue through 27 April. Two weaker coronal holes are due to return to a geo-effective position on 29 April – 02 May and 06 – 08 May with unsettled to active conditions expected. On 12 May, a large southern coronal hole is due to return and may result in unsettled to isolated major storm levels from 12 – 18 May.

*** Note:** On April 8, SEC began using data from the GOES 12 satellite, and stop using GOES 8 data. SEC tracks two GOES satellites and designates one as the primary GOES satellite and the other the secondary GOES satellite. With the end of GOES 8, the primary/secondary designations will change. GOES 10 is the primary GOES satellite for magnetometer, XRS x-ray measurements, and energetic particles, with GOES 12 as the secondary source where available.

Daily Solar Data

Date	Radio Flux 10.7 cm	Sun spot No.	Sunspot Area (10^{-6} hemi.)	*X-ray Background	Flares: X-ray Flux C	M	X	Flares: Optical S	1	2	3	4
14 April	102	63	430	B1.1	1	0	0	1	0	0	0	0
15 April	101	54	320	B1.0	0	0	0	0	0	0	0	0
16 April	99	40	80	B1.2	0	0	0	0	0	0	0	0
17 April	101	37	170	B1.5	1	0	0	0	0	0	0	0
18 April	108	51	420	B2.0	0	1	0	0	0	0	0	0
19 April	112	69	440	B2.0	0	0	0	1	0	0	0	0
20 April	119	93	600	B2.2	1	0	0	3	0	0	0	0

*Daily Particle Data

Date	Proton Fluence (protons/cm^2-day-sr) >1MeV	>10MeV	>100MeV	Electron Fluence (electrons/cm^2-day-sr) >.6MeV	>2MeV	>4MeV
14 April	1.3E+6	1.0E+4	3.5E+3		9.7E+7	
15 April	1.2E+6	1.1E+4	3.7E+3		3.3E+7	
16 April	6.6E+6	1.0E+4	3.9E+3		1.0E+8	
17 April	9.3E+6	1.1E+4	3.9E+3		3.7E+8	
18 April	2.6E+6	1.1E+4	3.9E+3		3.8E+8	
19 April	1.9E+6	1.0E+4	3.7E+3		3.1E+8	
20 April	1.7E+6	1.1E+4	4.2E+3		1.4E+8	

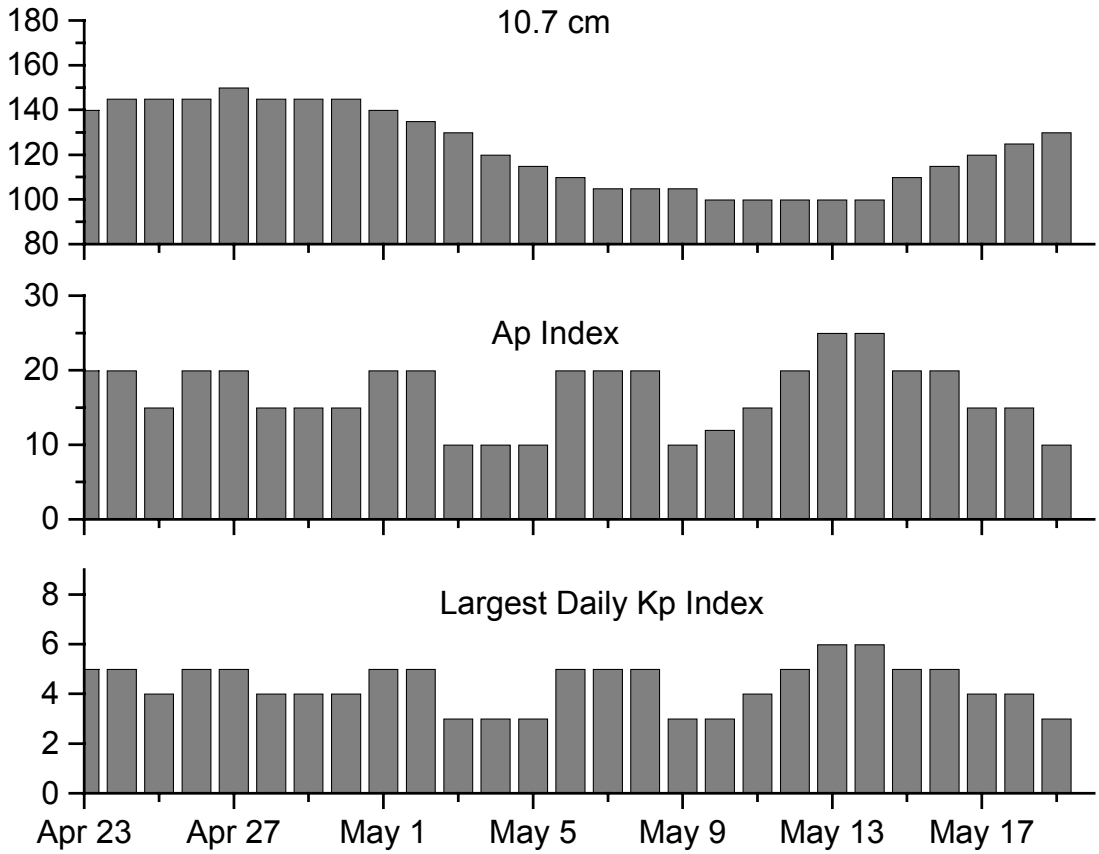
Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg A	K-indices	High Latitude College A	K-indices	Estimated Planetary A	K-indices
14 April	13	3-3-2-2-2-2-3-4	22	3-3-2-5-3-5-3-3	16	2-3-1-2-5-4-3-3
15 April	13	3-3-2-2-2-2-3-4	34	3-4-4-7-5-1-2-2	22	4-4-4-5-4-2-2-3
16 April	13	3-3-2-2-2-2-3-4	54	5-3-5-7-5-6-4-4	31	4-3-4-6-3-3-5-4
17 April	20	3-4-4-4-3-4-3-2	51	3-5-6-6-6-6-3-2	30	3-5-5-5-4-5-3-3
18 April	18	1-4-4-3-4-3-3-3	27	2-3-4-6-5-4-2-2	20	2-5-4-4-4-3-3-3
19 April	10	3-2-3-2-2-2-2-3	*	2-2-1-*-3-2-2-2	18	3-3-3-0-3-3-2-3
20 April	12	3-3-2-2-2-2-3-4	16	3-4-4-3-2-3-3-2	16	4-4-4-2-3-3-2-4

Alerts and Warnings Issued

Date & Time of Issue	Type of Alert or Warning	Date & Time of Event UT
14 Apr 0106	1 - 245 MHz Burst	13 Apr
14 Apr 0435	WARNING: Geomagnetic K= 4 expected	Apr 14 0435 -Apr 14 1500
14 Apr 0438	ALERT: Geomagnetic K= 4	Apr 14 0438
14 Apr 1448	EXTENDED WARNING: Geomagnetic K=4 expected	Apr 14 0435 -Apr 14 2359
15 Apr 0215	WARNING: Geomagnetic K= 4 expected	Apr 15 0215 -Apr 15 1500
15 Apr 0217	ALERT: Geomagnetic K= 4	Apr 15 0216
15 Apr 0923	WARNING: Geomagnetic K= 5 expected	15 Apr 0925 -1500
15 Apr 1035	ALERT: Geomagnetic K= 5	15 Apr 1035
15 Apr 1457	EXTENDED WARNING: Geomagnetic K= 4 expected	15 Apr 0215 -16 Apr 1500
15 Apr 2012	ALERT: Electron 2MeV Integral Flux > 1000pfu	15 Apr 1950
16 Apr 0950	ALERT: Geomagnetic K= 5	16 Apr 0949
16 Apr 1440	EXTENDED WARNING: Geomagnetic K= 4 expected	15 Apr 0215 -16 Apr 2359
16 Apr 1750	ALERT: Electron 2MeV Integral Flux > 1000pfu	16 Apr 1720
16 Apr 2015	WATCH: Geomagnetic A ≥ 20	17 Apr
16 Apr 2319	EXTENDED WARNING: Geomagnetic K= 4 expected	15 Apr 0215 -17 Apr 1500
17 Apr 0511	WARNING: Geomagnetic K= 5 expected	17 Apr 0513 - 1500
17 Apr 0516	ALERT: Geomagnetic K= 5	17 Apr 0515
17 Apr 1043	ALERT: Electron 2MeV Integral Flux > 1000pfu	17 Apr 1020
17 Apr 1457	EXTENDED WARNING: Geomagnetic K= 4 expected	15 Apr 0215 -17 Apr 2359
18 Apr 1336	ALERT: Electron 2MeV Integral Flux > 1000pfu	18 Apr 1125
19 Apr 0110	1 - 245 MHz Burst	18 Apr
19 Apr 0031	WARNING: Geomagnetic K-index of 4 expected	18 Apr 2359 -19 Apr 1500
19 Apr 1112	ALERT: Electron 2MeV Integral Flux > 1000pfu	19 Apr 1050
20 Apr 0436	ALERT: Geomagnetic K=4	20 Apr 0434
20 Apr 0638	WARNING: Geomagnetic K= 4 expected	20 Apr 0638 - 1500
20 Apr 0644	ALERT: Geomagnetic K= 4	20 Apr 0643
20 Apr 1645	ALERT: Electron 2MeV Integral Flux > 1000pfu	20 Apr 1620
20 Apr 1751	ALERT: Geomagnetic K-index of 4	20 Apr 1744
20 Apr 1754	WARNING: Geomagnetic K= 4 expected	20 Apr 1800 -21 Apr 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
23 Apr	140	20	5	07 May	105	20	5
24	145	20	5	08	105	20	5
25	145	15	4	09	105	10	3
26	145	20	5	10	100	12	3
27	150	20	5	11	100	15	4
28	145	15	4	12	100	20	5
29	145	15	4	13	100	25	6
30 Apr	145	15	4	14	100	25	6
01 May	140	20	5	15	110	20	5
02	135	20	5	16	115	20	5
03	130	10	3	17	120	15	4
04	120	10	3	18	125	15	4
05	115	10	3	19	130	10	3
06	110	20	5				

Energetic Events

Date	Time			*X-ray		Optical Information			Peak Radio Flux		Sweep Freq Intensity	
	Begin	Max	½ Max	Class	Integ Flux	Imp/ Brtns	Location Lat CMD	Rgn #	245	2695	II	IV
18 Apr	1950	1958	2002	M1.1	.004			337		41		

Flare List

Date	Time Begin	Time Max	Time End	*X-ray Class.	Optical Imp / Brtns	Optical Location Lat CMD	Rgn
14 April	0310	0314	0317	B1.8			
	0602	0605	0607	B1.6			
	0818	0819	A0825	B6.4	Sf	S05E60	
	0900	0930	0955	C1.1			335
	1309	1313	1316	B2.9			
	1500	1505	1512	B2.3			
15 April	0738	0741	0746	B1.8			334
	1348	1356	1400	B4.4			330
	1932	1938	1944	B3.7			334
16 April	0323	0326	0340	B2.0			
	1609	1612	1616	B2.1			
17 April	1058	1101	1104	B2.8			
	2204	2216	2236	C4.4			
18 April	1047	1052	1057	B6.6			337
	1147	1152	1156	B7.6			337
	1353	1400	1412	B4.8			337
	1606	1610	1616	B3.3			
	1618	1626	1638	B5.6			
	1950	1958	2002	M1.1			337
19 April	B1440	U1440	1447	B4.0	Sf	N17E27	
	2030	2033	2036	B5.1			
	2307	2313	2318	B5.7			
20 April	0217	0224	0229	B7.6			
	0307	0312	0319	B6.2			
	0728	0730	0732		Sf	S13E67	337
	1759	1802	1806	B6.1			
	1921	1922	1937	C4.4	Sf	N18W49	339
	2146	2146	2155		Sf	N17W42	339
	2258	2301	2305	B4.8			

see note on page 2.

Region Summary

Date	Location (° Lat ° CMD)	Helio Lon	Sunspot Characteristics Area (10^{-6} hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	Flares X-ray C	M	X	Optical S	1	2	3	4
			Region 330												
03 Apr	N07E74	083	0140	04	Hhx	001	A								
04 Apr	N07E62	082	0330	04	Hhx	001	A								
05 Apr	N07E49	081	0400	03	Hkx	001	A								
06 Apr	N07E38	079	0380	06	Dko	003	B								
07 Apr	N07E24	080	0330	07	Cko	005	B								
08 Apr	N07E10	081	0390	06	Cko	007	Bg								
09 Apr	N08W02	080	0420	06	Dko	014	Bg								
10 Apr	N07W16	081	0380	06	Chi	016	B								
11 Apr	N07W31	082	0360	06	Cho	013	B								
12 Apr	N07W43	081	0340	06	Dho	018	B								
13 Apr	N07W57	082	0330	06	Dho	009	B	1			1				
14 Apr	N08W71	083	0300	06	Cho	006	B								
15 Apr	N09W86	085	0200	04	Hhx	001	A								
								1	0	0	1	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 080

Date	Location (° Lat ° CMD)	Helio Lon	Sunspot Characteristics Area (10^{-6} hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	Flares X-ray C	M	X	Optical S	1	2	3	4
			Region 332												
07 Apr	N11E58	046	0020	01	Hsx	001	A								
08 Apr	N11E45	046	0020	01	Bxo	002	A								
09 Apr	N11E31	047	0030	02	Cso	003	B								
10 Apr	N11E18	047	0010	01	Axx	002	A								
11 Apr	N10E04	047	0000	01	Axx	002	A								
12 Apr	N12W07	045	0010	03	Cso	006	B								
13 Apr	N12W20	045	0020	02	Cso	004	B								
14 Apr	N12W33	045	0020	04	Cso	007	B								
15 Apr	N12W47	046	0030	03	Cro	004	B								
16 Apr	N12W60	046													
17 Apr	N12W73	046													
18 Apr	N12W86	046													
								0	0	0	0	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 047

Region Summary - continued.

Date	Location (° Lat ° CMD)	Helio Lon	Sunspot Characteristics Area (10^{-6} hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	Flares X-ray C	X-ray M	X-ray X	Optical S	Optical 1	Optical 2	Optical 3	Optical 4
			Region 334												
10 Apr	S08E69	356	0110	03	Cao	006	B								
11 Apr	S08E55	356	0120	03	Cao	004	B								
12 Apr	S08E43	355	0110	03	Cao	006	B								
13 Apr	S08E29	356	0100	03	Cao	005	B								
14 Apr	S08E16	356	0070	04	Cso	007	B								
15 Apr	S08E02	357	0060	04	Cso	007	B								
16 Apr	S10W12	357	0060	04	Cao	005	B								
17 Apr	S08W24	356	0060	04	Dso	004	B								
18 Apr	S08W38	357	0060	02	Hsx	001	A								
19 Apr	S07W51	357	0030	02	Hsx	001	A								
20 Apr	S07W65	358	0030	01	Hsx	001	A								
								0	0	0	0	0	0	0	0
Still on Disk.															
Absolute heliographic longitude:		357													
			Region 335												
13 Apr	S21E56	329	0040	03	Cso	003	B								
14 Apr	S21E42	330	0040	03	Dso	003	B	1							
15 Apr	S22E28	331	0030	02	Dso	002	B								
16 Apr	S21E20	325	0020	07	Cao	015	B								
17 Apr	S22E06	326	0010	06	Bxo	002	B								
18 Apr	S22W09	328	0020	06	Bxo	007	B								
19 Apr	S21W21	327	0030	04	Bxo	007	B								
20 Apr	S23W33	326	0020	04	Bxo	006	B								
								1	0	0	0	0	0	0	0
Still on Disk.															
Absolute heliographic longitude:		326													
			Region 336												
17 Apr	N12E75	257	0100	02	Hsx	001	A								
18 Apr	N13E62	257	0160	02	Hax	001	A								
19 Apr	N13E50	256	0120	03	Hax	001	A								
20 Apr	N13E37	256	0150	03	Hax	002	A								
								0	0	0	0	0	0	0	0
Still on Disk.															
Absolute heliographic longitude:		256													
			Region 337												
18 Apr	S12E74	245	0180	03	Hkx	002	A		1						
19 Apr	S14E66	239	0240	09	Cao	006	B								
20 Apr	S14E55	238	0340	10	Dko	010	B				1				
								0	1	0	1	0	0	0	0
Still on Disk.															
Absolute heliographic longitude:		238													

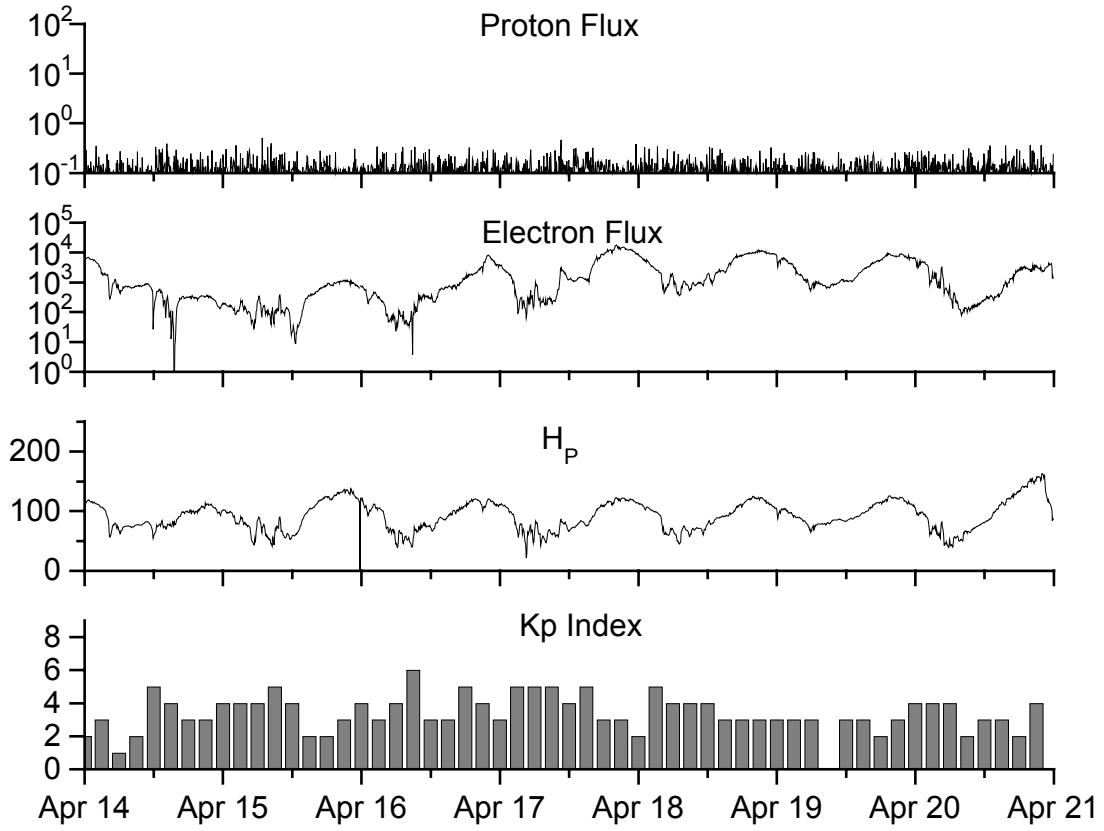
Region Summary - continued.

Date	Location (° Lat ° CMD)	Helio Lon	Sunspot Characteristics: Area (10^{-6} hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	Flares: X-ray C	X-ray M	X-ray X	Optical S	Optical 1	Optical 2	Optical 3	Optical 4
	Region 338														
19 Apr	N18E26	280	0020	11	Bxo	004	B								
20 Apr	N18E09	284	0040	08	Dso	008	B								
								0	0	0	0	0	0	0	0
Still on Disk.															
Absolute heliographic longitude:		284													
	Region 339														
20 Apr	N18W45	338	0020	05	Cso	006	Bg	1			2				
								1	0	0	2	0	0	0	0
Still on Disk.															
Absolute heliographic longitude:		338													

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

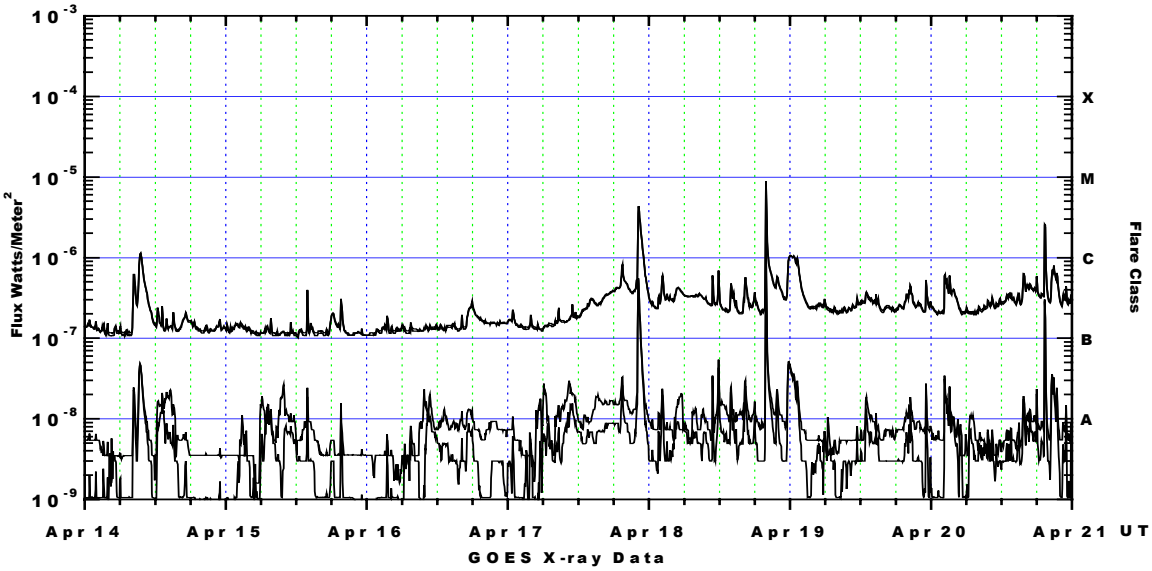
	Sunspot Numbers					Radio Flux		Geomagnetic	
	Observed values		Ratio	Smooth values		*Penticton	Smooth	Planetary	Smooth
Month	SWO	RI	RI/SWO	SWO	RI	10.7 cm	Value	Ap	Value
				2001					
April	163.6	108.2	0.66	159.4	107.7	178.1	171.7	18	12.7
May	135.1	97.3	0.72	163.1	108.8	147.9	174.8	12	12.5
June	196.7	134.0	0.68	167.2	109.9	173.7	178.8	12	12.4
July	124.6	82.2	0.66	172.1	111.8	131.3	183.9	11	12.4
August	159.4	106.8	0.67	176.7	113.8	163.1	188.8	13	12.5
September	229.1	150.7	0.66	178.8	114.3	233.8	191.3	13	12.8
October	197.4	125.6	0.64	179.5	114.1	208.1	191.9	20	12.0
November	178.6	106.5	0.60	183.7	115.6	212.7	193.7	16	12.0
December	217.5	132.2	0.61	184.5	114.6	235.6	193.9	09	12.2
				2002					
January	189.0	114.1	0.60	184.8	113.5	227.3	194.6	08	12.4
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	113.4	180.3	195.7	10	13.0
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	0.61	179.9	106.3	148.7	183.0	11	13.5
July	183.5	99.9	0.54	175.4	102.7	173.5	176.3	13	13.9
August	191.0	116.4	0.61	169.3	98.7	183.9	169.5	16	14.3
September	206.4	109.6	0.53	163.4	94.6	175.8	164.2	14	14.9
October	153.9	97.5	0.63			167.0		23	
November	159.8	95.5	0.60			168.7		16	
December	147.9	80.8	0.55			158.6		13	
				2003					
January	149.3	79.5	0.53			144.6		13	
February	87.9	46.2	0.53			124.6		15	
March	119.7	61.5	0.51			132.3		19	

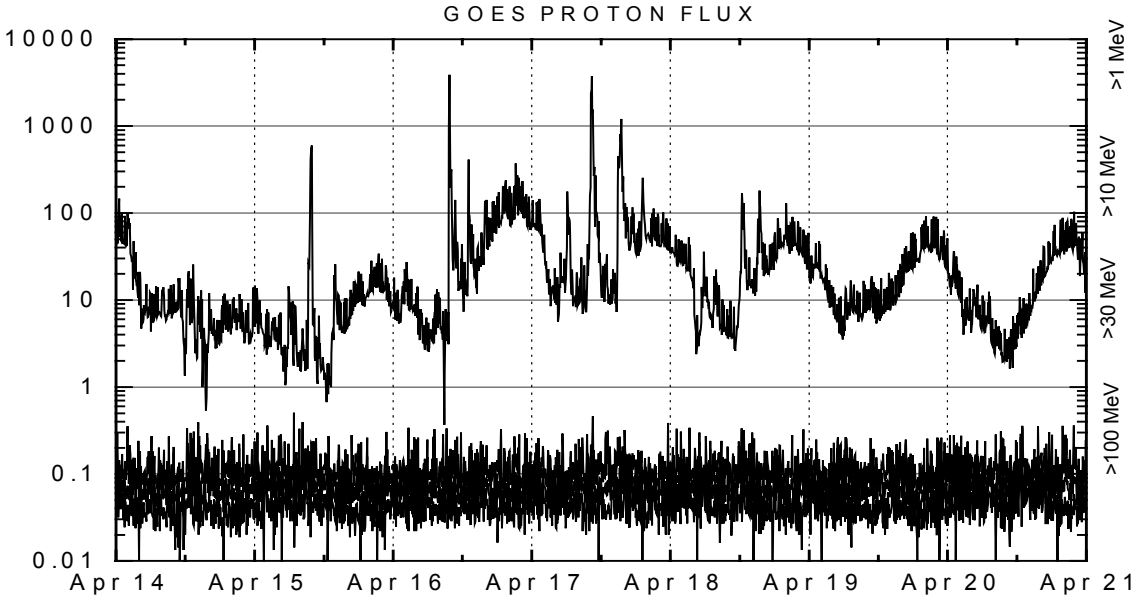
NOTE: All smoothed values after June 1999 and monthly values after December 2000 are preliminary estimates. The lowest smoothed sunspot index number for Cycle 22, RI = 8.0, occurred in May 1996. The highest smoothed sunspot number for Cycle 22, RI= 158.5, occurred July 1989. *After June 1991, the 10.7 cm radio flux data source is Penticton, B.C. Canada. Prior to that, it was Ottawa.



Weekly Geosynchronous Satellite Environment Summary
Week Beginning 14 April 2003
Protons plot contains the five-minute averaged integral proton flux (protons/cm^2 –sec –sr) as measured by GOES-10* (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^2 –sec –sr) with energies greater than 2 MeV at GOES-10.
Hp plot contains the five minute averaged magnetic field H - component in nanoteslas (nT) as measured by GOES-10*. The H component is parallel to the spin axis of the satellite, which is nearly parallel to the Earth's rotation axis.
Kp 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 Kp 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 Kp are " global " parameters that are applicable to a first order approximation over large areas. Hparallel is subject to more localized phenomena and the measurements generally are applicable to within a few degrees of longitude of the measuring satellite.

**** see note on page 2***





Weekly GOES Satellite X-ray and Proton Plots

X-ray plot contains five-minute averaged x-ray flux (watts/$m^{2)}$ as measured by GOES 10* and 12 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/cm^2 –sec-sr) as measured by GOES-10* (W75) for each of the energy thresholds: >1, >10, >30 and >100 MeV. P10 event threshold is 10 pfu (protons/cm^2-sec-sr) at greater than 10 MeV

**** see note on page 2***