

**Space Weather Highlights**  
**15 – 21 January 2001**

**SWO PRF 1325**  
**23 January 2001**

Solar activity reached high levels during the period. Activity was low during 15 - 18 January due to isolated to occasional C-class flares. Activity increased to moderate levels on 19 January with an isolated M1/Sf flare at 19/1730 UTC from Region 9313 (S07, L = 272, class/area Eao/220 on 20 January). Activity increased to high levels on 20 January as Region 9313 produced a M7/2b flare at 20/2120 UTC with an associated 850 sfu Tenflare, Type II radio sweep, and a halo CME. Region 9313 also produced a M1/2f parallel ribbon flare at 20/1847 UTC associated with a Type II radio sweep and a halo CME. Both flares occurred during a period of gradual growth in the region. Activity declined to moderate levels on the last day of the period with an isolated M1/Sf flare at 21/2313 UTC from Region 9313.

Data were available from the Advanced Composition Explorer (ACE) spacecraft for most of the period. There were no transient or high speed stream signatures observed during the period. Relatively brief solar sector boundary crossings occurred on 17, 20, and 21 January. Periods of sustained southward IMF Bz were associated with the boundary crossings of 20 - 21 January with maximum southerly deflections to minus 13 nT (GSM).

There were no proton events detected at geosynchronous orbit. However, the greater than 10 MeV proton flux at geosynchronous orbit became enhanced following the M7/2b flare on 20 January.

The greater than 2 MeV electron flux at geosynchronous orbit was at normal levels.

Geomagnetic field activity was at quiet to unsettled levels during 15 - 20 January with a brief period of active levels early on 20 January. Activity increased to quiet to minor storm levels on 21 January with active to minor storm levels detected during the 21/0900 - 1200 UTC interval.

**Space Weather Outlook**  
**24 January - 19 February 2001**

Solar activity is expected to be at mostly low levels with isolated M-class flares possible sometime during the period.

No proton events are expected during the period.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to be at normal to moderate levels.

Geomagnetic field activity is expected to be at mostly active levels during 24 January with a fair chance for some isolated storm periods. This activity is expected in response to the CME activity observed on 20 January. Activity is expected to be at quiet to unsettled levels for the remainder of the period, barring another Earth-directed CME.



### Daily Solar Data

Date	Radio Flux 10.7 cm	Sun spot No.	Sunspot Area (10 <sup>6</sup> hemi.)	X-ray Background	Flares							
					X-ray Flux			Optical				
					C	M	X	S	1	2	3	4
15 January	169	154	720	B6.7	8	0	0	4	0	0	0	0
16 January	162	115	540	B5.5	6	0	0	1	0	0	0	0
17 January	152	71	270	B7.9	8	0	0	4	0	0	0	0
18 January	152	99	310	B5.8	3	0	0	0	0	0	0	0
19 January	153	134	520	B4.8	1	1	0	4	0	0	0	0
20 January	153	91	520	B7.3	5	2	0	0	0	2	0	0
21 January	152	108	500	B7.3	3	1	0	7	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	>4Me
15 January	9.5E+5	2.0E+4	2.3E+3		1.2E+6	
16 January	1.4E+6	1.6E+4	2.3E+3		1.9E+6	
17 January	9.4E+5	1.2E+4	2.4E+3		3.1E+6	
18 January	8.3E+5	1.1E+4	2.2E+3		2.2E+5	
19 January	4.8E+5	1.0E+4	2.4E+3		2.7E+5	
20 January	2.8E+5	1.0E+4	2.2E+3		4.6E+5	
21 January	3.9E+5	1.5E+4	2.3E+3		1.1E+5	

### Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	15 January	3	0-0-2-1-1-0-1-2	17	0-0-1-5-5-3-2-3	7
16 January	4	1-0-2-2-2-1-1-0	*	2-0-2-2-5-3-*. *	6	0-0-2-2-3-2-3-1
17 January	4	2-1-0-0-1-2-2-1	*	*-0-0-0-0-2-2-0	7	3-1-0-1-2-3-3-2
18 January	4	1-0-1-1-2-2-1-1	3	0-0-1-1-3-0-0-0	4	0-0-1-2-1-2-2-2
19 January	3	1-2-0-0-1-0-1-2	1	0-0-0-0-2-0-0-1	4	1-1-0-0-2-2-2-2
20 January	6	0-1-3-2-2-1-1-2	17	0-0-5-3-5-3-2-1	8	0-0-3-2-3-2-3-3
21 January	12	2-1-3-4-3-2-2-3	36	1-1-4-7-4-5-4-3	18	2-2-3-5-4-3-3-4



*Alerts and Warnings Issued*

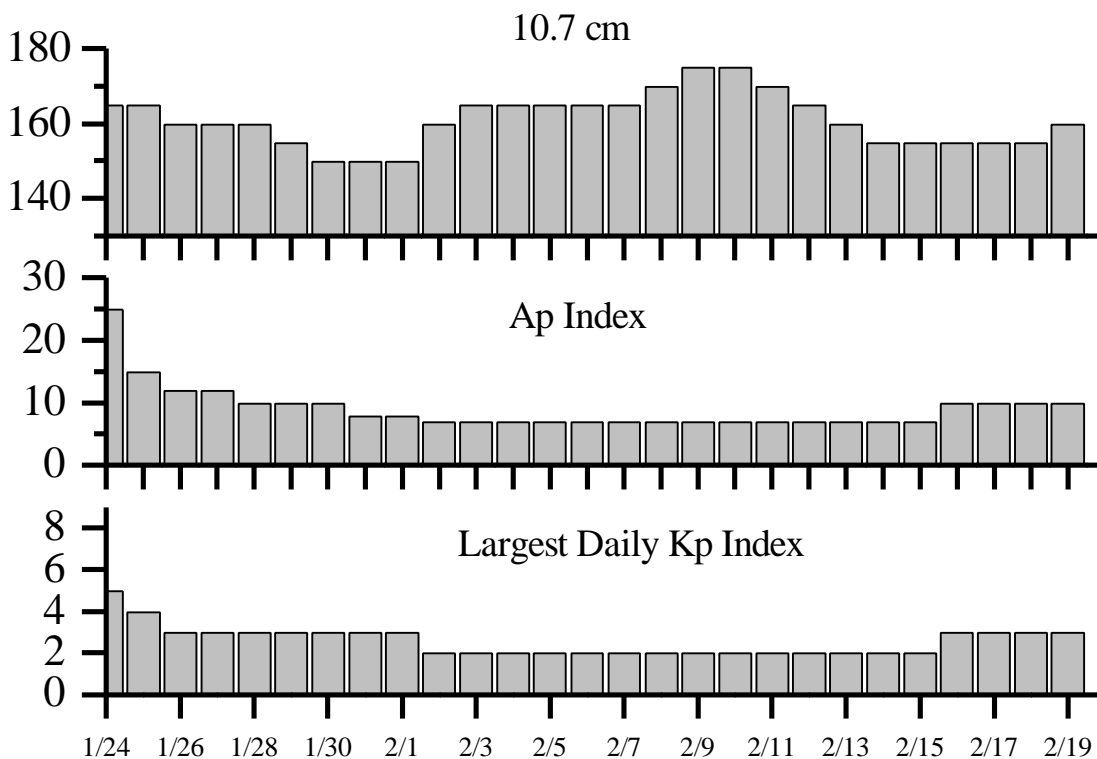
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Date & Time of Issue	Type of Alert or Warning	Date & Time of Event UT
16 Jan 0014	245 MHz Noise Storms	15 Jan
17 Jan 0018	1 - 245 MHz Bursts	16 Jan
17 Jan 0018	245 MHz Noise Storms	16 Jan
17 Jan 0148	Type II Radio Emission	17 Jan 0128
17 Jan 0207	Type IV Radio Emission	17 Jan 0150
17 Jan 1645	Sudden Impulse observed at Boulder	17 Jan 1631
18 Jan 0117	6 - 245 MHz Bursts	17 Jan
20 Jan 0900	K= 4 Observed	20 Jan 0600 - 0900
20 Jan 1949	Type II Radio Emission	20 Jan 1842 UT
20 Jan 2124	X-Ray event M7/2b/s07e46	20 Jan 2106
20 Jan 2128	10cm Radio Burst 850 F.U.	20 Jan 2127
20 Jan 2130	Type II Radio Emission	20 Jan 2001 2114
21 Jan 0012	1 - 245 MHz Bursts	20 Jan
21 Jan 1146	K-Index of 4 Warning	21 Jan 1200 - 2100
21 Jan 1158	K-Index of 5 Observed	21 Jan 0900 - 1200

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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
24 Jan	165	25	5	07 Feb	165	7	2
25	165	15	4	08	170	7	2
26	160	12	3	09	175	7	2
27	160	12	3	10	175	7	2
28	160	10	3	11	170	7	2
29	155	10	3	12	165	7	2
30	150	10	3	13	160	7	2
31 Jan	150	8	3	14	155	7	2
01 Feb	150	8	3	15	155	7	2
02	160	7	2	16	155	10	3
03	165	7	2	17	155	10	3
04	165	7	2	18	155	10	3
05	165	7	2	19	160	10	3
06	165	7	2				



### *Energetic Events*

Date	Time		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
19 Jan	1625	1730	1819	M1.0	.043	Sf	S07E61	9313	150			
20 Jan	1833	1847	1859	M1.2	.012	2f	S07E40	9313	43	110	3	
20 Jan	2106	2120	2132	M7.7	.072	2b	S07E46	9313	600	850	2	
21 Jan	2308	2312	2319	M1.1	.005	Sf	N05W32	9311				

### *Flare List*

Date	Time			X-ray Class.	Imp / Brtns	Optical		Rgn
	Begin	Max	End			Location Lat CMD		
15 January	0103	0106	0116	C1.9	Sf	N12W29	9306	
	0902	0904	0907	C1.2	Sf	N11W34	9306	
	1132	1136	1141	C1.1				
	1304	1311	1321	C2.9				
	1602	1602	1618	C9.4	Sf	N12W37	9306	
	1846	1848	1854	C4.9	Sf	N13W37	9306	
	2019	2024	2027	C1.3				
16 January	2330	2336	2342	C1.9				
	0022	0027	0032	C1.3				
	0259	0304	0320	C1.1				
	0608	0609	0619	C2.2	Sf	N12W44	9306	
	1509	1530	1558	C2.4				
	1952	1957	2001	C1.8				
17 January	2038	2042	2049	C1.1				
	0123	0155	0218	C2.5				
	0303	0305	0310		Sf	N12W56	9306	
	0351	0351	0356	C1.8	Sf	N14W53	9306	
	0539	0616	0650	C4.0				
	0916	0919	0925	C1.3				
	1133	1134	1137	C1.1	Sf	N12W66	9304	
	1219	1315	1402	C1.6				
	1818	1822	1826	C1.0				
18 January	2047	2051	2057	C2.3	Sf	N16W64	9306	
	1252	1256	1305	C1.0				
	1525	1634	1725	C2.9				
19 January	2240	2320	2335	C1.3				
	0124	0130	0140	B9.3				
	0310	0311	0314		Sf	N05W59	9306	
	0317	0317	0319		Sf	N05W60	9306	
	1059	1102	1111	B8.5				
	1131	1236	1311	C1.8				
	1639	1726	1807	M1	Sf	S07E61	9313	
	1933	1934	1937		Sf	S07E61	9313	



**Flare List – continued.**

Date	Begin	Time		X-ray	Optical		Rgn	
		Max	End		Class	Imp / Brtns		Location Lat CMD
20 January		0005	0016	0023	C1.3			
		0157	0201	0203	C1.1			
		0313	0317	0320	C1.0			
		0849	0856	0900	C1.49			
		1004	1007	1013	B8.5			
		1235	1239	1243	B8.0			
		1428	1431	1435	C1.0			
		B1840	U1853	2002	M1.2	2f	S07E40	9313
21 January		2108	2119	2226	M7.7	2b	S07E46	9313
		0807	0814	0821	B7.3			
		1219	1223	1227	C1.7			
		1346	1350	1403	B7.8			
		1450	1450	1454		Sf	S19W37	
		1725	1729	1734	B6.9			
		1919	1923	1956	C3.0	Sf	S08E36	9313
		2114	2117	2122	C4.5	Sf	N06W32	9311
		2235	2238	2254		Sf	S09E27	9313
		2245	2245	2251		Sf	N06W34	9311
		2254	2256	2303		Sf	N06W35	9311
	2307	2311	2338	M1.1	Sf	N05W32	9311	

**Region Summary**

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

*Region 9300*

04 Jan	S14E55	110	0010	01	Axx	002	A										
05 Jan	S13E44	108	0000	00	Axx	001	A										
06 Jan	S13E32	106	0020	03	Cso	004	B										
07 Jan	S14E18	107	0020	03	Cro	006	B										
08 Jan	S13E06	106	0010	03	Bxo	004	B										
09 Jan	S13W06	106															
10 Jan	S13W19	106															
11 Jan	S13W32	106															
12 Jan	S13W45	106															
13 Jan	S13W58	106															
14 Jan	S13W71	106															
15 Jan	S13W84	106															

0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 106



### 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 9301</i>																	
04 Jan	N07E73	092	0020	01	Axx	002	A	1			1						
05 Jan	N07E61	091	0040	01	Hsx	001	A										
06 Jan	N07E48	090	0040	06	Cao	003	B										
07 Jan	N08E34	091	0040	05	Dso	004	B										
08 Jan	N08E22	090	0020	04	Cso	002	B										
09 Jan	N07E06	093	0010	01	Hsx	001	A										
10 Jan	N08W06	092	0020	05	Cso	003	B										
11 Jan	N08W20	093	0030	01	Hsx	001	A	1			1						
12 Jan	N09W32	091	0030	03	Cso	004	B										
13 Jan	N08W45	091	0040	04	Cso	004	B										
14 Jan	N08W58	091	0020	06	Cso	004	B										
15 Jan	N08W73	093	0000	01	Axx	002	A										
16 Jan	N08W86	093	0000	00		000											
								2	0	0	2	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude: 093

<i>Region 9302</i>																	
05 Jan	N19E66	086	0110	09	Cso	005	B	2			3						
06 Jan	N19E52	086	0090	08	Dso	005	B	1			1						
07 Jan	N20E39	086	0080	06	Cso	005	B	1									
08 Jan	N18E25	087	0070	03	Dso	003	B	1									
09 Jan	N18E12	087	0090	03	Cso	002	B										
10 Jan	N18W02	088	0080	04	Dso	008	B	1	1		1	1					
11 Jan	N18W15	088	0070	03	Cao	007	B										
12 Jan	N19W28	087	0050	03	Cao	006	B	1			1						
13 Jan	N19W41	087	0060	04	Cao	003	B	2			2						
14 Jan	N19W54	087	0030	04	Cso	004	B										
15 Jan	N19W69	089	0000	03	Bxo	002	B										
16 Jan	N19W82	089															
17 Jan	N19W95	089															
								9	1	0	8	1	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	4			
<i>Region 9304</i>																		
07 Jan	N11E58	067	0080	16	Fso	007	B											
08 Jan	N12E44	068	0040	10	Dso	007	B											
09 Jan	N11E29	070	0050	09	Dao	006	B											
10 Jan	N11E14	072	0050	09	Dso	005	B											
11 Jan	N12W01	074	0030	02	Hax	003	A											
12 Jan	N11W16	075	0030	01	Cao	002	B											
13 Jan	N11W30	076	0030	01	Hsx	001	A											
14 Jan	N11W44	077	0030	01	Hsx	001	A											
15 Jan	N12W56	076	0000	01	Axx	001	A											
16 Jan	N11W70	076	0020	02	Hsx	001	A											
17 Jan	N11W83	076						1				1						
								1	0	0	1	0	0	0	0	0		

Crossed West Limb.

Absolute heliographic longitude: 074

<i>Region 9305</i>																		
07 Jan	S07E64	061	0020	02	Cro	002	B											
08 Jan	S07E50	062	0000	00	Axx	001	A											
09 Jan	S07E37	062																
10 Jan	S07E24	062																
11 Jan	S07E10	063	0010	01	Axx	002	A											
12 Jan	S06W04	063	0010	01	Axx	002	A											
13 Jan	S06W17	063																
14 Jan	S06W30	063																
15 Jan	S06W43	063																
16 Jan	S06W56	063																
17 Jan	S06W69	063																
18 Jan	S06W82	063																
								0	0	0	0	0	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude: 063









**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 9314</i>																		
18 Jan	N15W44	023	0000	00	Axx	001	A											
19 Jan	N17W58	024	0010	02	Bxo	003	B											
20 Jan	N17W71	024																
																		0 0 0 0 0 0 0 0
Still on Disk.																		
Absolute heliographic longitude: 023																		
<i>Region 9315</i>																		
19 Jan	S28E44	282	0030	06	Cso	002	B											
20 Jan	S28E31	282																
21 Jan	S28E18	282																
																		0 0 0 0 0 0 0 0
Still on Disk.																		
Absolute heliographic longitude: 282																		
<i>Region 9316</i>																		
19 Jan	S17E75	251	0100	02	Hsx	003	A											
20 Jan	S17E64	249	0200	09	Dso	007	B											
21 Jan	S16E50	250	0130	07	Dao	004	B											
																		0 0 0 0 0 0 0 0
Still on Disk.																		
Absolute heliographic longitude: 250																		
<i>Region 9317</i>																		
19 Jan	N08W72	038	0030	03	Bxo	002	B											
20 Jan	N08W85	038																
																		0 0 0 0 0 0 0 0
Still on Disk.																		
Absolute heliographic longitude: 038																		
<i>Region 9318</i>																		
20 Jan	S05E05	308	0020	03	Dso	002	B											
21 Jan	S04W09	309	0010	04	Bxo	006	B											
																		0 0 0 0 0 0 0 0
Still on Disk.																		
Absolute heliographic longitude: 308																		
<i>Region 9319</i>																		
21 Jan	S20W43	343	0030	03	Cso	005	B											
																		0 0 0 0 0 0 0 0
Still on Disk.																		
Absolute heliographic longitude: 343																		



***Region Summary- continued.***

Location		Sunspot Characteristics					Flares							
Date	( ° 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 9320</i>														
21 Jan	S25E01	299	0020	03	Cso	003	B							
								0	0	0	0	0	0	0
Still on Disk.														
Absolute heliographic longitude: 299														
<i>Region 9321</i>														
21 Jan	S05E69	231	0100	09	Dao	003	B							
								0	0	0	0	0	0	0
Still on Disk.														
Absolute heliographic longitude: 231														

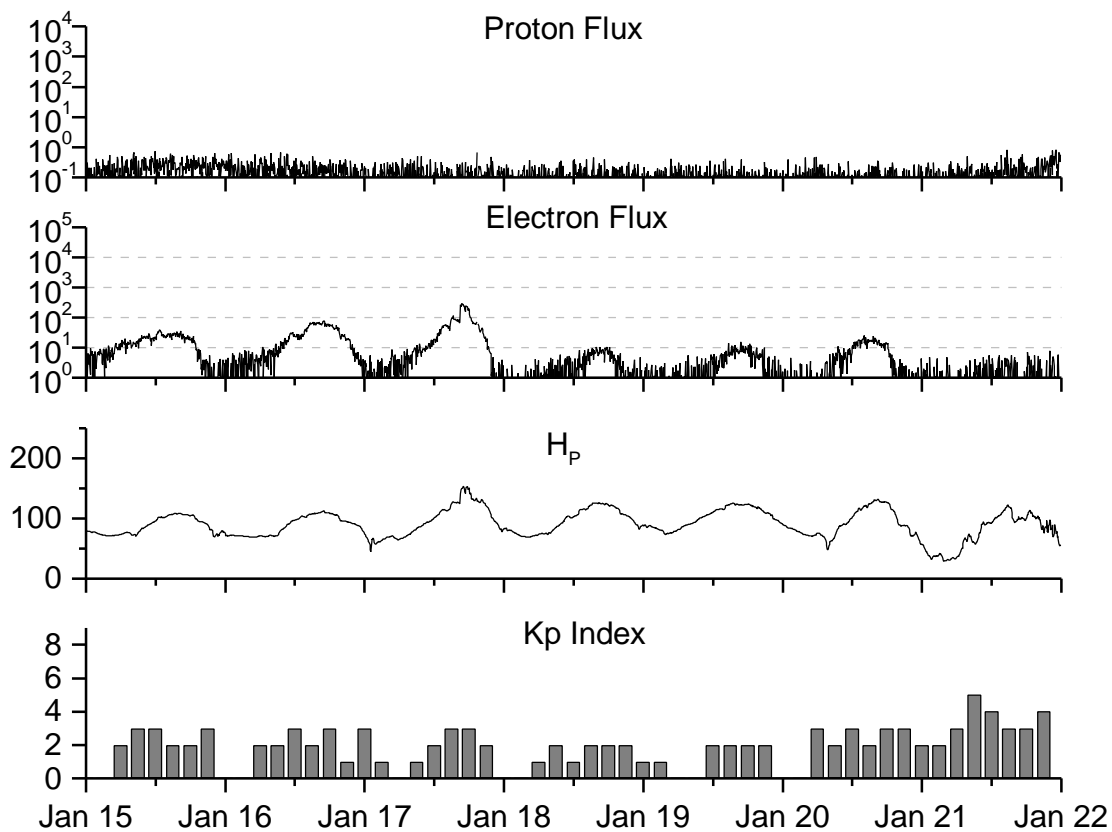


**Recent Solar Indices (preliminary)  
of the observed monthly mean values**

Month	Sunspot Numbers				Radio Flux		Geomagnetic		
	Observed values		Ratio	Smooth values		*Penticton	Smooth	Planetary	Smooth
	SWO	RI	RI/SWO	SWO	RI	10.7 cm	Value	Ap	Value
<b>1999</b>									
January	94.3	62.0	0.66	116.5	82.6	142.6	139.0	10	11.7
February	93.4	66.3	0.71	120.2	84.6	142.0	142.6	12	11.6
March	100.5	68.8	0.68	120.5	83.8	126.3	144.0	14	11.7
April	92.9	63.7	0.69	123.8	85.5	117.2	145.8	12	12.2
May	140.5	106.4	0.76	131.7	90.5	148.6	149.9	08	12.4
June	208.3	137.7	0.66	136.0	93.1	169.8	152.9	07	12.4
July	169.2	113.5	0.67	138.0	94.3	165.6	154.4	10	12.6
August	136.1	93.7	0.69	142.8	97.5	170.8	156.3	15	12.9
September	107.4	71.5	0.67	150.0	102.3	135.7	161.0	19	12.8
October	167.7	116.7	0.70	158.5	107.8	164.8	167.2	19	12.7
November	199.3	133.2	0.67	164.7	110.9	191.5	171.5	14	13.1
December	123.5	86.4	0.69	165.9	111.0	169.8	173.4	10	13.8
<b>2000</b>									
January	140.8	90.1	0.64	168.0	112.8	158.1	175.5	13	14.5
February	161.9	112.9	0.70	172.1	116.6	173.2	176.8	15	15.1
March	203.6	138.5	0.68	175.4	119.8	208.2	178.4	09	15.1
April	193.4	125.3	0.65	176.3	120.7	184.2	180.5	15	14.9
May	188.8	120.8	0.64	173.1	118.9	184.5	180.1	15	14.8
June	190.3	124.9	0.66	172.0	118.6	179.8	179.7	15	14.8
July	236.7	169.1	0.71			204.7		21	
August	166.6	130.5	0.78			163.1		18	
September	157.9	109.9	0.70			182.1		16	
October	138.9	100.1	0.72			167.8		16	
November	149.9	106.5	0.71			178.8		16	
December	146.4	104.5	0.71			173.8		07	

**NOTE:** All smoothed values after September 1999 and monthly values after March 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 15 January 2001*

*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.

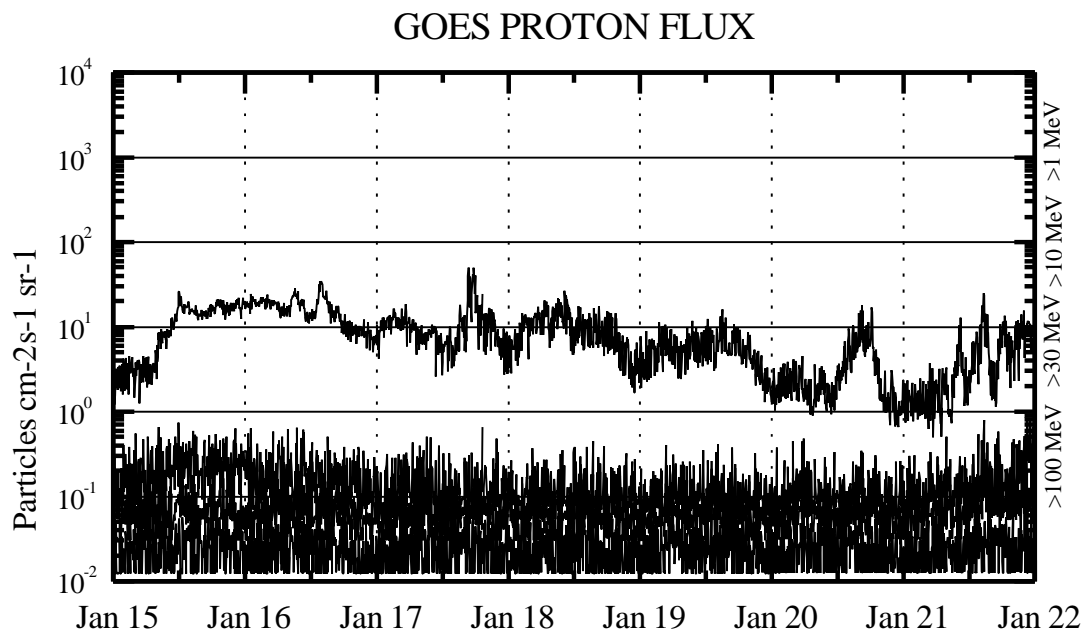
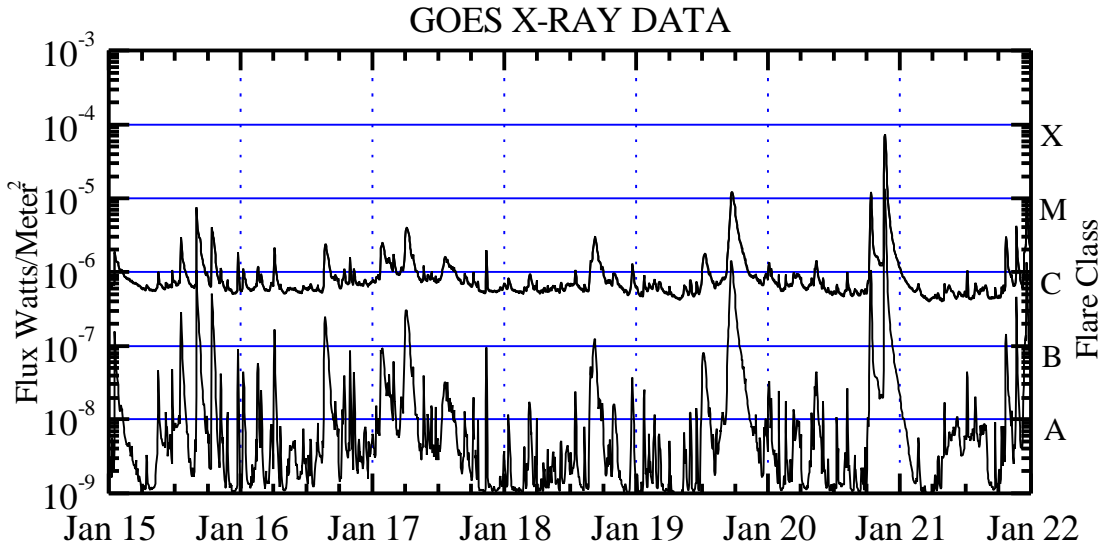
*Electrons* plot contains the five-minute averaged integral electron flux (electrons/cm<sup>2</sup>-sec -sr) with energies greater than 2 MeV at GOES-8.

*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 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/m<sup>2</sup>) 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 (protons/cm<sup>2</sup>-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 (protons/cm<sup>2</sup>-sec-sr) at greater than 10 MeV.

