

## **Space Weather Highlights 23 - 29 December 2002**

**SWO PRF 1426  
31 December 2002**

Solar activity ranged from very low to low levels over the course of the period. For flare times and magnitudes please refer the energetic and optical flare lists. Region 224 (S14, L=114, class/area Dao/470 on 23 December) was the source of the largest events of the period, producing a pair of C5 flares on 24 December. Region 226 (S28, L=124, class/area Fko/460 on 23 December) produced a C3 flare event on 23 December. An optically uncorrelated C4 flare was observed on 25 December, when regions 224 and 226 both transited the west limb. Activity on 26 and 29 December was limited to low level C-class flares associated with eruptive filaments. Very low activity persisted during 27 through 28 December, with only occasional B-class flares. A long duration, low magnitude X-ray enhancement was observed on 28 December, in association with an apparent backside CME observed off the northwest limb. Regions 233 through 239 were numbered during the summary period, all remaining fairly regions are small, simply structured, and mostly quiescent. Refer to the region summary list for specific region details.

Solar wind data were available from the NASA Advanced Composition Explorer (ACE) spacecraft for most of the summary period. Solar wind velocity was elevated for much of the period, due to transient effects and a recurrent coronal hole. A six-hour period of sustained southward Bz values, and solar wind velocities near 600 km/s, were observed on 23 December. A transient shock passage occurred at approximately 1300 UTC on 24 December, in likely association with an M-class event and CME, which was observed three days earlier. In response to a recurrent coronal hole, solar wind velocity began to increase late on 26 December and reached a peak value near 750 km/s on 28 December.

Solar wind velocity fell to about 550 km/s by the end of the period on 29 December.

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 24-25 December and 28-29 December, in the wake of the episodic high speed stream effects described above.

The geomagnetic field ranged from quiet to major storm levels over the course of the summary period. An isolated period of minor storming was observed on 23 December due to a sustained southward IMF accompanied by high velocity solar wind. Periods of active conditions were observed on 24-25 December, in response to a transient shock passage. Unsettled to minor storm conditions, with an isolated major storm period, occurred during 26-28 December due to recurrent coronal hole effects.

## **Space Weather Outlook 01 - 27 January 2003**

Solar activity is expected to persist at very low to low levels until about 07 January, when formerly productive active regions (including, among others, old regions 224 and 226 described above) are expected to return to the visible disk over the course of the following four days. Moderate flare activity may be possible for the subsequent two-week period (through 23 January), depending on the characteristics of the expected returning regions. Low to moderate activity is possible for the remainder of the forecast period.

There is a slight chance of a greater than 10 MeV proton event during the latter half of the forecast period.

The greater than 2 MeV electron flux at geo-synchronous orbit is expected to reach event threshold on 04 January, 16-17 January, and 23-25 January, in response to recurrent high speed stream effects.

The geomagnetic field is expected to be in the range of quiet to active levels for most of the forecast period. Active conditions are possible on 04 January, due to expected effects from a compact, trans-equatorial coronal hole. Periods of enhanced geomagnetic activity are possible on 15-16 January and 22-24 January, due to the expected influence of recurrent coronal holes.



### *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
23 December	159	160	1600	B7.4	5	0	0	6	0	0	0	0
24 December	147	119	700	B7.1	5	0	0	7	0	0	0	0
25 December	132	77	350	B7.4	5	0	0	1	0	0	0	0
26 December	127	62	310	B4.2	2	0	0	4	0	0	0	0
27 December	117	63	200	B2.7	0	0	0	3	0	0	0	0
28 December	117	70	150	B2.6	1	0	0	0	0	0	0	0
29 December	115	51	100	B1.9	0	0	0	0	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
	23 December	5.0E+5	1.4E+4	2.2E+3		1.1E+6
24 December	6.3E+5	1.2E+4	2.3E+3		2.0E+7	
25 December	2.3E+5	1.1E+4	2.2E+3		2.7E+7	
26 December	1.5E+5	1.1E+4	2.4E+3		1.0E+7	
27 December	1.5E+6	1.2E+4	2.6E+3		4.9E+6	
28 December	1.9E+6	1.3E+4	2.7E+3		4.1E+7	
29 December	8.3E+5	1.2E+4	2.8E+3		1.1E+8	

### *Daily Geomagnetic Data*

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	23 December	12	2-1-3-3-2-3-3-3	40	2-2-4-7-6-3-4-3	26
24 December	14	2-1-3-2-4-4-3-2	37	3-1-3-6-6-6-3-2	18	3-2-3-3-4-4-3-3
25 December	10	2-2-2-2-2-2-4-2	28	2-2-4-5-6-4-4-1	14	3-3-3-3-4-3-3-3
26 December	8	1-1-1-2-2-2-2-4	27	0-0-3-6-5-5-3-2	15	2-2-2-4-4-4-3-4
27 December	22	3-5-3-4-3-4-3-3	52	4-5-4-6-6-6-5-4	37	4-6-4-5-5-4-4-3
28 December	12	3-3-3-3-3-2-2-1	41	3-3-6-6-6-4-4-1	19	4-4-4-4-3-4-3-2
29 December	8	3-1-2-2-2-2-2-2	23	1-2-3-6-5-3-3-1	13	3-2-3-3-3-3-3-3

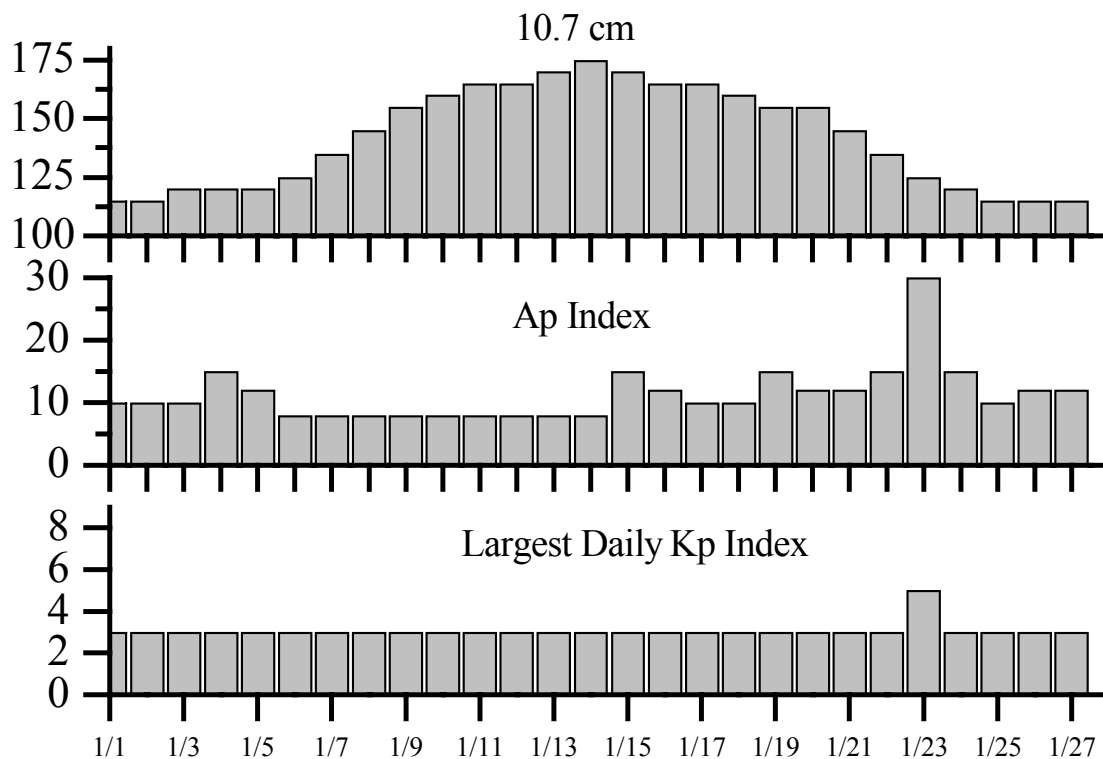


### *Alerts and Warnings Issued*

<u>Date &amp; Time of Issue</u>	<u>Type of Alert or Warning</u>	<u>Date &amp; Time of Event UT</u>
23 Dec 0008	2 - 245 MHz Radio Bursts	22 Dec
23 Dec 0744	ALERT: Geomagnetic K = 4	23 Dec 0743
23 Dec 0958	WARNING: Geomagnetic K = 4	23 Dec 0958 - 1500
23 Dec 1000	ALERT: Geomagnetic K = 4	23 Dec 1000
23 Dec 1049	WARNING: Geomagnetic K = 5	23 Dec 1049 - 1500
23 Dec 1527	WARNING: Geomagnetic K = 4 expected	23 Dec 1527 - 24 Dec 1500
24 Dec 0020	1 - 245 MHz Radio Burst	23 Dec
24 Dec 1456	EXTENDED WARNING: Geomagnetic K= 4 expected	23 Dec 1527 - 24 Dec 2359
24 Dec 1521	ALERT: Electron 2MeV Integral Flux exceeded 1000pfu	24 Dec 1505
25 Dec 1440	ALERT: Electron 2MeV Integral Flux exceeded 1000pfu	25 Dec 1420
25 Dec 1459	ALERT: Geomagnetic K = 4	25 Dec 1453
25 Dec 2152	WATCH: Geomagnetic A $\geq$ 20	28 Dec
26 Dec 1635	ALERT: Geomagnetic K = 4	26 Dec 1632
26 Dec 2252	WARNING: Geomagnetic K = 4 expected	26 Dec 2255 - 27 Dec 1500
26 Dec 2304	ALERT: Geomagnetic K = 4	26 Dec 2302
27 Dec 0413	WARNING: Geomagnetic K = 5 expected	27 Dec 0413 - 28 Dec 1500
27 Dec 0415	ALERT: Geomagnetic K = 5	27 Dec 0410
27 Dec 1417	ALERT: STRATWARM	27 Dec
27 Dec 1455	EXTENDED WARNING: Geomagnetic K = 4 expected	26 Dec 2255 -27 Dec 2359
27 Dec 1456	EXTENDED WARNING: Geomagnetic K = 5 expected	27 Dec 0413 - 2359
27 Dec 2026	WATCH: Geomagnetic A $\geq$ 20	28 Dec
27 Dec 2354	EXTENDED WARNING: Geomagnetic K = 4 expected	26 Dec 2255 - 28 Dec 1500
28 Dec 1230	ALERT: Electron 2MeV Integral Flux exceeded 1000pfu	28 Dec 1215
28 Dec 1357	ALERT: STRATWARM	28 Dec
28 Dec 1449	EXTENDED WARNING: Geomagnetic K = 4 expected	26 Dec 2255 - 28 Dec 2359
28 Dec 2349	EXTENDED WARNING: Geomagnetic K = 4 expected	26 Dec 2255 - 29 Dec 1500
29 Dec 1117	ALERT: Electron 2MeV Integral Flux exceeded 1000pfu	29 Dec 1055
29 Dec 1325	ALERT: STRATWARM	29 Dec



### 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
01 Jan	115	10	3	15 Jan	170	15	3
02	115	10	3	16	165	12	3
03	120	10	3	17	165	10	3
04	120	15	3	18	160	10	3
05	120	12	3	19	155	15	3
06	125	8	3	20	155	12	3
07	135	8	3	21	145	12	3
08	145	8	3	22	122	15	3
09	155	8	3	23	125	30	5
10	160	8	3	24	120	15	3
11	165	8	3	25	115	10	3
12	165	8	3	26	115	12	3
13	170	8	3	27	115	12	3
14	175	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

**No Events Observed**

**Flare List**

Date	Time			X-ray Class.	Imp / Brtns	Location Lat CMD	Rgn
	Begin	Max	End				
23 December	0050	0050	0054		Sf	S13W57	224
	0541	0543	0550		Sf	N21W43	229
	0618	0621	0625		Sf	N21W42	229
	0715	0719	0722	C3.8			
	0917	0919	0923		Sf	S17W63	224
	1158	1202	1209	C1.1			
	1230	1234	1241	C1.3			
	B1520	U1520	1530	C1.6	Sf	S25W31	231
	2105	2115	2125	C1.7			
24 December	2339	2339	2342		Sf	S26W78	226
	0259	0302	0308		Sf	S07W21	230
	0524	0527	0534	C5.8	Sf	S15W69	224
	0540	0542	0556		Sf	S07W22	230
	B1326	U1326	1336	C1.6	Sf	S15W79	224
	B1446	U1446	1539	C5.8	Sf	S15W75	224
	B1642	U1642	1721		Sf	S08W30	230
	1811	1821	1833	C2.7			
	2046	2047	2051		Sf	S15W86	224
25 December	2316	2336	2339	C2.7			
	0540	0546	0552	C4.8			
	1153	1207	1214	C3.5			
	1749	1809	1829	C2.9			
	2129	2137	2143	C1.7	Sf	S09W45	230
26 December	2244	2248	2251	C1.1			
	0159	0201	0212	C1.4	Sf	S08W48	230
	0451	0452	0458	B8.1	Sf	S09W50	230
	0823	0835	0851	C1.9			
	1953	1958	2011		Sf	N13E15	235
27 December	B2012	U2013	2018		Sf	N12E18	235
	B1333	U1333	1347		Sf	S07W66	230
	1649	1651	1656	B6.5	Sf	N17W24	236
	2154	2154	2207	B6.3	Sf	N14E02	235
28 December	1722	1839	1946	B9.3			
	2304	2314	2323	C1.4			
29 December	0155	0205	0226	B9.9			
	0441	0446	0504	B3.5			



### 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 223</i>																	
12 Dec	N23E71	121	0070	02	Hsx	001	A					1					
13 Dec	N24E60	119	0130	06	Cso	006	B	1				2					
14 Dec	N23E46	119	0140	04	Dso	005	B					2					
15 Dec	N24E34	118	0140	04	Cai	007	B										
16 Dec	N24E21	118	0110	05	Dso	008	B										
17 Dec	N25E08	118	0140	05	Dso	011	B	1				1					
18 Dec	N25W06	118	0140	04	Cso	007	B										
19 Dec	N25W19	118	0080	03	Cao	004	B					1					
20 Dec	N25W32	118	0280	04	Dao	004	B										
21 Dec	N25W45	118	0050	04	Cso	005	B										
22 Dec	N25W58	118	0050	04	Cao	004	B		1					1			
23 Dec	N22W67	113	0170	07	Cao	003	B										
24 Dec	N24W83	116	0020	01	Axx	001	A										
								2	1	0	7	0	1	0	0	0	

Crossed West Limb.

Absolute heliographic longitude: 118

<i>Region 224</i>																	
12 Dec	S16E70	122	0090	05	Dao	003	B										
13 Dec	S17E61	118	0220	15	Eao	011	B	1				2					
14 Dec	S18E49	116	0290	13	Eai	022	Bg					1					
15 Dec	S18E36	116	0200	15	Eai	025	Bg										
16 Dec	S15E22	117	0120	11	Eao	013	B										
17 Dec	S14E06	120	0160	13	Eao	026	B										
18 Dec	S14W08	120	0140	15	Eao	033	B	2				2					
19 Dec	S14W21	120	0050	16	Fro	017	B										
20 Dec	S14W32	118	0070	10	Dao	018	B										
21 Dec	S14W45	118	0070	10	Dso	013	B										
22 Dec	S14W58	118	0150	10	Dao	022	B					1					
23 Dec	S15W68	114	0470	10	Dao	022	Bg					2					
24 Dec	S14W81	114	0230	10	Dao	010	Bg	3				4					
25 Dec	S14W92	112	0100	06	Dao	004	B										
								6	0	0	12	0	0	0	0	0	

Crossed West Limb.

Absolute heliographic longitude: 120



**Region Summary - continued.**

Date	Location		Sunspot Characteristics				Flares											
	Helio		Area (10 <sup>-6</sup> hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical							
	( ° Lat ° CMD)	Lon						C	M	X	S	1	2	3	4			
<i>Region 225</i>																		
13 Dec	N17E66	113	0120	10	Dao	009	B											
14 Dec	N17E51	114	0140	09	Dai	009	B						3					
15 Dec	N16E38	114	0100	07	Dai	014	B						1					
16 Dec	N17E23	116	0100	08	Dai	015	Bg	1					1					
17 Dec	N17E11	115	0110	08	Dai	014	Bg						1					
18 Dec	N17W03	115	0090	09	Dao	014	Bg											
19 Dec	N17W18	117	0040	05	Cao	006	B											
20 Dec	N17W33	119	0030	01	Hsx	001	A											
21 Dec	N17W46	119	0020	01	Axx	002	A											
22 Dec	N17W59	119																
23 Dec	N18W62	108	0000	00	Axx	001	A											
24 Dec	N18W75	108																
25 Dec	N18W88	108																

0 1 0 5 1 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 115

<i>Region 226</i>																		
13 Dec	S28E51	128	0070	06	Dso	008	B						8					
14 Dec	S28E39	126	0170	08	Dai	019	B	4					9	1				
15 Dec	S28E25	127	0290	12	Eki	020	B	3					5					
16 Dec	S28E12	127	0320	14	Eki	028	Bg	3	1				7	1				
17 Dec	S28W01	127	0560	16	Fki	042	Bgd	5	1				7					
18 Dec	S28W15	127	0720	17	Fki	047	Bgd	1	1				4	1				
19 Dec	S28W28	127	0690	20	Fkc	045	Bgd	6					8					
20 Dec	S28W41	127	0720	21	Fkc	041	Bgd	7	1				7	1				
21 Dec	S28W54	127	0510	21	Fkc	029	Bgd	4					5	1				
22 Dec	S28W67	127	0360	21	Fki	026	Bgd											
23 Dec	S28W78	124	0460	22	Fko	013	Bg						1					
24 Dec	S28W89	122	0110	11	Eao	004	B											

33 4 0 61 5 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 127



**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 228</i>																
14 Dec	S14E65	100	0040	01	Hsx	001	A					1				
15 Dec	S15E52	100	0020	01	Hrx	001	A									
16 Dec	S17E37	102	0010	01	Axx	001	A									
17 Dec	S17E24	102														
18 Dec	S17E10	102	0010	04	Bxo	004	B									
19 Dec	S17W03	102	0010	03	Bxo	002	B									
20 Dec	S17W16	102	0010	03	Bxo	002	B									
21 Dec	S14W26	099														
22 Dec	S14W39	099														
23 Dec	S14W52	099														
24 Dec	S14W65	099														
25 Dec	S14W78	099														

0 0 0 1 0 0 0 0

Crossed West Limb.  
 Absolute heliographic longitude: 102

<i>Region 229</i>																
14 Dec	N15E63	102	0220	07	Dai	007	B					4				
15 Dec	N17E51	101	0400	10	Dki	028	B	2				3				
16 Dec	N18E37	102	0410	12	Ehi	028	Bg	1				2	1			
17 Dec	N19E24	102	0320	13	Eki	038	Bg	1				1				
18 Dec	N19E12	102	0440	14	Eki	037	Bg									
19 Dec	N19W03	102	0230	14	Eai	021	Bg		1			1		2		
20 Dec	N19W16	102	0200	16	Fao	023	Bg									
21 Dec	N19W29	102	0140	15	Eao	023	Bg	1				2				
22 Dec	N19W42	102	0080	10	Dao	011	Bg									
23 Dec	N22W51	097	0120	09	Dao	010	B							2		
24 Dec	N25W63	096	0050	04	Dso	004	B									
25 Dec	N26W75	095	0020	01	Axx	001	A									
26 Dec	N27W90	097	0010	01	Axx	001	A									

5 1 0 15 1 2 0 0

Crossed West Limb.  
 Absolute heliographic longitude: 102





**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 230</i>																		
17 Dec	S08E59	067	0070	07	Dao	005	B											
18 Dec	S08E45	067	0150	07	Dao	010	B	1				1						
19 Dec	S08E32	067	0210	13	Eai	012	Bg	1				2						
20 Dec	S08E19	067	0310	12	Eki	018	Bg	2				3						
21 Dec	S08E06	067	0300	13	Eai	027	Bg											
22 Dec	S08W07	067	0220	10	Dho	022	Bg											
23 Dec	S09W21	067	0310	10	Dho	021	Bg											
24 Dec	S08W34	067	0170	08	Dso	009	Bg					3						
25 Dec	S08W50	070	0100	02	Hax	002	A	1				1						
26 Dec	S07W63	070	0120	03	Cao	003	B	1				2						
27 Dec	S08W77	071	0060	03	Hsx	002	A					1						
28 Dec	S08W91	072	0050	02	Hsx	001	A											
								6	0	0	13	0	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude: 067

<i>Region 231</i>																		
19 Dec	S25E13	086	0020	04	Cso	002	B											
20 Dec	S25E00	086	0020	06	Dso	005	B											
21 Dec	S25W13	086	0030	07	Cao	006	B											
22 Dec	S25W26	086	0050	08	Dao	010	B											
23 Dec	S25W39	085	0050	08	Dao	006	B	1				1						
24 Dec	S25W53	086	0050	09	Dao	005	B											
25 Dec	S25W62	082	0060	05	Cao	004	B											
26 Dec	S24W77	084	0110	06	Cso	003	B											
27 Dec	S25W89	083	0050	08	Cso	004	B											
								1	0	0	1	0	0	0	0	0	0	

Crossed West Limb.

Absolute heliographic longitude: 086

<i>Region 232</i>																		
21 Dec	N13W08	081	0020	00	Dao	003	B											
22 Dec	N13W21	081	0020	05	Dao	003	B											
23 Dec	N13W33	080																
24 Dec	N13W46	080																
25 Dec	N13W59	080																
26 Dec	N13W72	080																
27 Dec	N13W85	080																
								0	0	0	0	0	0	0	0	0	0	

Crossed West Limb.

Absolute heliographic longitude: 081



**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 233*

23 Dec	N11E42	004	0020	02	Bxo	004	B											
24 Dec	N13E27	006	0030	04	Cro	005	B											
25 Dec	N13E14	006																
26 Dec	N13E01	006																
27 Dec	N13W12	006																
28 Dec	N13W25	006																
29 Dec	N13W38	006																

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 006

*Region 234*

24 Dec	N18E73	320	0040	02	Hsx	001	A											
25 Dec	N17E58	322	0060	07	Cso	003	B											
26 Dec	N17E45	322	0060	04	Cao	002	B											
27 Dec	N18E32	322	0050	02	Hsx	001	A											
28 Dec	N19E19	322	0040	03	Cao	005	B											
29 Dec	N18E05	322	0040	02	Hsx	001	A											

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 322

*Region 235*

25 Dec	N13E28	352	0010	03	Bxo	003	B											
26 Dec	N14E15	352	0010	03	Bxo	003	B											2
27 Dec	N13E05	349	0010	03	Bxo	002	B											1
28 Dec	N13W08	349																
29 Dec	N14W22	349	0010	03	Cso	004	B											

0 0 0 3 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 349

*Region 236*

27 Dec	N17W27	021	0030	03	Cao	004	B											1
28 Dec	N16W41	022	0040	04	Dso	007	B											
29 Dec	N16W53	020	0020	01	Hax	001	A											

0 0 0 1 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 021



**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 237</i>																						
28 Dec	S26E00	341	0010	05	Bxo	005	B															
29 Dec	S26W13	341																				
Still on Disk.																						
Absolute heliographic longitude: 341																						
<i>Region 238</i>																						
28 Dec	N09E15	326	0010	01	Axx	002	A															
29 Dec	N08E02	326																				
Still on Disk.																						
Absolute heliographic longitude: 326																						
<i>Region 239</i>																						
29 Dec	S10E37	290	0030	04	Cro	005	B															
Still on Disk.																						
Absolute heliographic longitude: 290																						

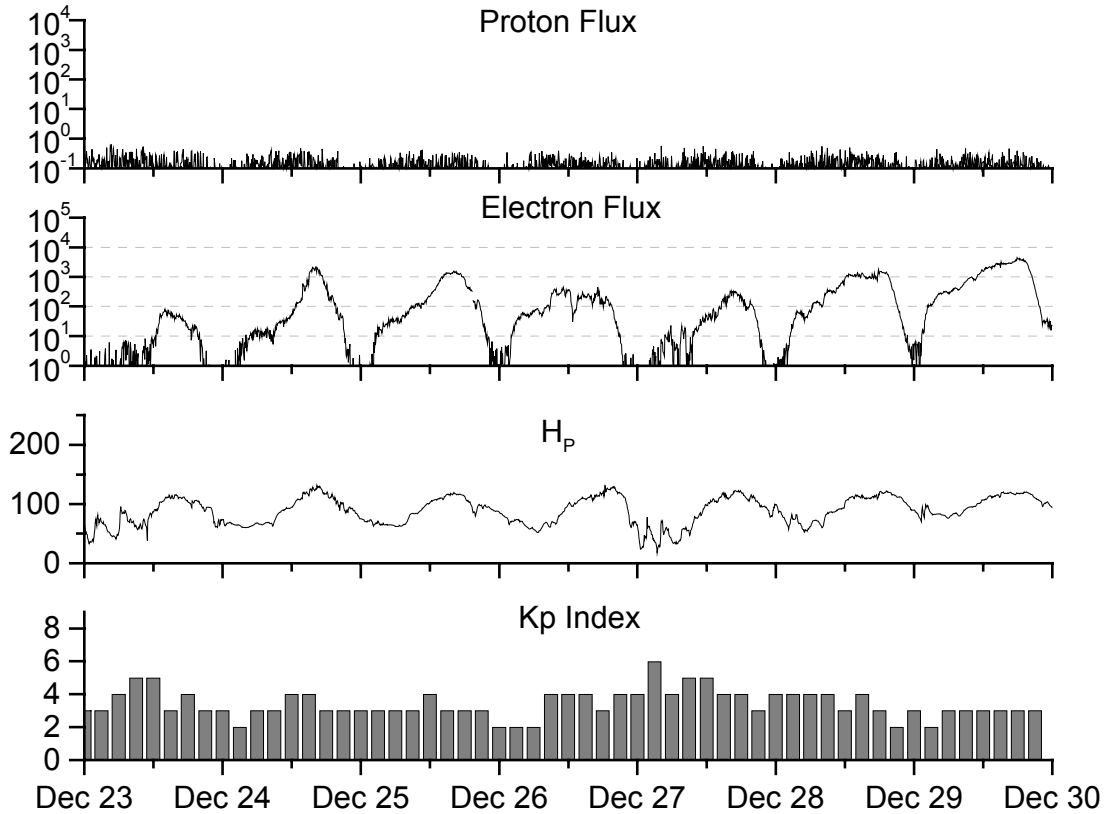


**Recent Solar Indices (preliminary)  
of the observed monthly mean values**

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
<b>2000</b>									
December	146.4	104.5	0.71	160.8	112.1	173.6	172.1	08	14.4
<b>2001</b>									
January	142.7	95.1	0.67	156.3	108.8	166.7	168.8	08	13.8
February	131.0	80.1	0.61	151.4	104.2	147.3	165.8	06	13.3
March	166.7	114.2	0.69	154.0	104.9	177.7	167.9	17	12.9
April	163.6	108.2	0.66	159.4	107.7	178.3	171.7	18	12.7
May	135.1	97.3	0.72	163.1	108.8	148.7	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	163.2	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	131.8	0.61	184.5	114.7	235.6	193.9	09	12.2
<b>2002</b>									
January	189.0	113.9	0.60	184.8	113.5	227.3	194.6	08	12.4
February	194.5	108.0	0.56	188.6	114.7	205.0	197.2	10	12.8
March	153.1	98.1	0.64	188.9	113.3	180.3	195.7	10	13.0
April	194.9	120.4	0.62	186.2	110.4	189.8	191.5	15	13.2
May	204.1	120.8	0.59	183.6	108.8	178.4	188.0	15	13.3
June	146.0	88.5	0.61			148.7		11	
July	183.5	99.9	0.54			173.5		13	
August	191.0	116.4	0.61			183.9		16	
September	206.4	109.3	0.53			175.8		14	
October	153.9	97.5	0.63			167.0		23	
November	159.8	95.0	0.59			168.7		16	

**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 23 December 2002*

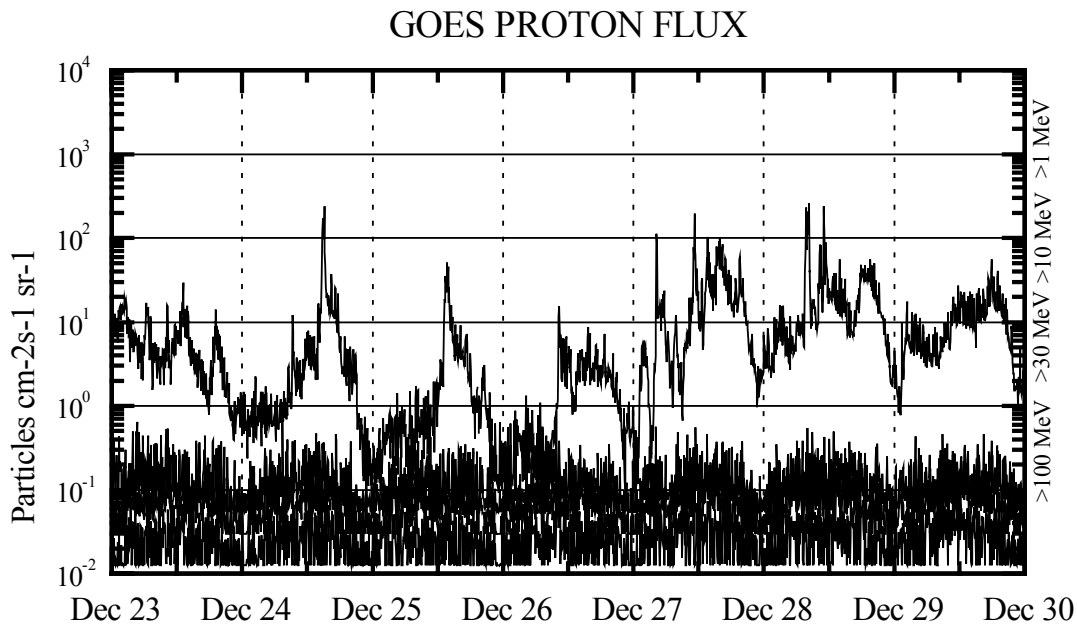
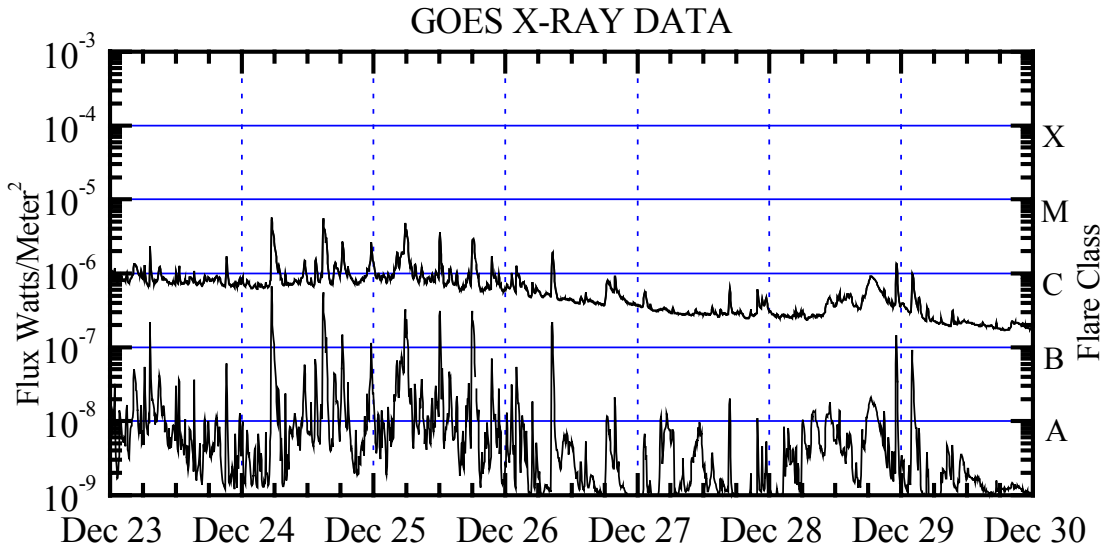
*Protons* plot contains the five-minute averaged integral proton flux (protons/cm<sup>2</sup>-sec -sr ) as measured by GOES-8 (W75) for each of three energy thresholds: greater than 10, 50, and 100 MeV.

*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 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<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.

